International Civil Aviation Organization

Eighth Meeting of the Aerodromes Operations and Planning Sub-Group (AOP/SG/8)

Bangkok, Thailand, 15 to 19 July 2024

Agenda Item 4: Provision of AOP in the Asia/Pacific Region

REPORT ON THE FIFTH MEETING OF THE ASIA/PACIFIC AERODROME DESIGN AND OPERATIONS TASK FORCE (AP-ADO/TF/5)

(Presented by Chairperson of AP-ADO/TF)

SUMMARY

This paper presents the Report of the Fifth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/5).

This paper relates to –

Strategic Objectives:

*A: **Safety** –Enhanced global civil aviation safety*

*B: **Air Navigation Capacity and Efficiency –** Increase Capacity and improve efficiency of the global civil aviation system*

1. INTRODUCTION

1.1 The Fifth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/5) was held in Wanasawan Meeting Room, Mae Fah Luang University, Chiang Rai, Thailand on 30 January - 2 February 2024. 62 participants from 14 Member States, 3 International Organization attended the Meeting.

1.2 There were 19 Working Papers, 5 Information Papers and 1 Flimsy considered by the Meeting.

1.3 The full report of the meeting is posted on the ICAO APAC Office website and can be accessed through the following link:
https://www.icao.int/APAC/Meetings/Pages/AP-ADO-TF-5.aspx

1.4 **Attachment A** to this Paper provides a Summary Report of the AP-ADO/TF/5 Meeting for review by the AOP/SG/8.

1.5 **Appendices** referred to in this Working Paper and **Attachment A** carry the same Appendix numbers as those in the Report of the AP-ADO/TF/5 Meeting for easy reference.

2. DISCUSSION

2.1 Some important discussions of the AP-ADO/TF/5 Meeting are summarized below:

Asia/Pacific Air Navigation Plan

2.2 The Secretariat presented the structure of the Asia/Pacific Air Navigation Plans (APAC ANPs) and the procedures for the amendment of these Plans. All three Volumes of Asia/Pacific Air Navigation Plan and the template of Proposal for Amendments (PfA) to APAC ANPs provided at https://www.icao.int/APAC/Pages/APAC-eANP.aspx.

2.3 AP-ADO/TF noted that among 355 international aerodromes in Asia and Pacific Regions only 282 international aerodromes had been listed in Asia/Pacific Region ANP Volume I by 2023.

Inconsistency Requirement in ICAO Annex 14 Volume I

2.4 AP-ADO/TF/5 noted the inconsistency observed in Annex 14 Volume I and Aerodrome Design Manual (Doc 9157) Part 4 vis-as-vis some best practices as recommended in ACI Handbook and FAA's study regarding requirements in Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe Marking, Runway Pavement Edge Flushing, and Precision Approach Lighting and endorsed the following Draft Conclusion for adoption by the Meeting:

<table>
<tr><td colspan="2">Draft Conclusion AP-ADO/TF/5 – 1: Inconsistency Requirements in ICAO Annex 14 Volume I (Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe, Pavement Edge Flushing, and Precision Approach Lighting)</td></tr>
<tr><td>What: That, ICAO HQ should be consulted on the inconsistency in and conflicting ICAO Annex 14 Volume I requirements (Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe Marking, Pavement Edge Flushing, and Precision Approach Lighting) identified in AP-ADO/TF-WP/06 (Appendix B to the AP-ADO/TF/5 Report) for further deliberation at the respective Working Groups (such as, Visual Aids Working Group and Aerodrome Design Working Group).</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: States to establish clear standard and recommended practices (SARPs) on Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe, Pavement Edge Flushing, and Precision Approach Lighting for enhancing safety and efficiency.</td><td>Follow-up: ☐Required from States</td></tr>
<tr><td>When: 19 July 24</td><td>Status: Adopted by Subgroup</td></tr>
<tr><td colspan="2">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

Safety Risk Warnings Related to the Temporary Ramp of the Runway Pavement Overlay

2.5 AP-ADO/TF/5 noted China's experience in runway overlay project where they had embedded the foot of the temporary ramp with a longitudinal slope of 1% into the existing pavement through milling into grooves. This method enhanced the stability of the temporary ramp and reduced the risk of FOD.

2.6 Regarding China's proposal to the ICAO for the revision of the longitudinal slope of the temporary ramp to 1%, some States expressed that they need to consult with their aerodrome operators and more research on this subject.

Review on the Color Shift Characteristics in relation to the Photometric Testing Requirements Pertaining to the Aeronautical Ground Lighting Systems using Solid State Lighting (LED)

2.7 AP-ADO/TF/5 noted the critical importance of monitoring color shift characteristics in Aeronautical Ground Lighting (AGL) systems, especially with the adoption of Solid State Lighting (LED) technology.

2.8 Acknowledging the benefit in including colour in the national requirements (as recommendations) to protect the interest of the airports and the regulator for ensuring the 4C's (Configuration, Colour, Candelas and Coverage) compliance of the AGL system, AP-ADO/TF/5 formulated the following Draft Conclusion for consideration by AOP/SG/8 regarding suggested amendment to 10.5.3 to 10.5.5 of Annex 14, Volume I for inclusion of the colour measurement:

<table>
<tr><td colspan="2">Draft Conclusion AP-ADO/TF/5 – 2: Proposal for Amendment to 10.5.3 to 10.5.5 of Annex 14, Volume I for inclusion of the colour measurement</td></tr>
<tr><td>What: That, ICAO Visual Aids Working Group is requested to review AP-ADO/TF/5 – WP/08 for consideration of the inclusion of the requirement for colour measurement as recommended in the WP/08 (Appendix D to the AP-ADO/TF/5 Report) in 10.5.3 to 10.5.5 of Annex 14, Volume I.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To protect the interest of the airports and the aviation regulator for ensuring the 4C's compliance of the AGL system.</td><td>Follow-up: ☐Required from States</td></tr>
<tr><td>When: 19 July 2024</td><td>Status: Adopted by Subgroup</td></tr>
<tr><td colspan="2">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
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Review on the Requirement of the Runway Guard Lights Provision when Stop Bars are available and Recommendations on the Stop Bar Operation Sequence Timings

2.9 AP-ADO/TF/5 reviewed the need for runway guard lights and the dependency of the stop bar lighting under different operational conditions. As per ICAO Annex 14, Volume I SARPs, the runway guard lights are required to be provided where stop bars are not installed when Runway Visual Range (RVR) is less than 550 meters.

2.10 AP-ADO/TF/5 discussed the stop bar operations functioning with timer operations. During a specific phase when stop bar is OFF and the taxiway centreline lights (TCLs) after the runway holding position are ON and this state would continue to function for a period of 30 sec to 90 sec, in which the runway holding position could not be identified clearly when RVR conditions are less than 550 m. In such conditions, considering the operational and safety requirements, the airports may require to install runway guard lights in addition to the stop bars.

2.11 In addition, the aspects of provision of runway guard lights when RVR in range of 550-1200 m when stop bar is installed, was proposed as a recommendation in AP-ADO/TF/5 – **WP/09**. As the standards have not referred any guidance on RVR conditions greater than 1200 m, the same has been proposed as a recommendation for providing the runway guard lights. However, it was suggested to follow based on the need and safety study.

2.12 AP-ADO/TF/5 recommended that AP-ADO/TF/5 – **WP/09** to be sent to ICAO HQs Visual Aids Working Group for further deliberation and formulated the following Draft Conclusion for consideration by AOP/SG/8:

<table>
<tr><td colspan="3">Draft Conclusion AP-ADO/TF/5 – 3: Review on the Requirement of the Runway Guard Lights Provision when Stop Bars are available and Recommendations on the Stop Bar Operation Sequence Timings</td></tr>
<tr><td colspan="2">What: That, ICAO Visual Aids Working Group is requested to review AP-ADO/TF/5 – WP/09 for consideration of recommendations made in the WP/09 in Section 5.1 b) and c) (Appendix E to the AP-ADO/TF/5 Report) regarding runway guard lights</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To enhance runway safety through operations of runway guard lights as part of effective runway incursion prevention measures in all visibility or weather conditions.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 19 July 2024</td><td colspan="2">Status: Adopted by Subgroup</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

<u>Open-Air Storm Water Conveyance in Runway Strip</u>

2.13 As per ICAO Annex 14, Volume I SARPs and ADM (Doc 9157), Part 1 the open-air drains should be designed and constructed as far as possible away from the runway. Though the information is given in the Note -1 of Recommendation 3.4.16, the note itself does not constitute as a part of the recommendation. Therefore, the application of the Note-1 has been left to the judgement of the aerodrome planners.

2.14 AP-ADO/TF/5 noted that in the *FAA advisory circular: AC150/5300-13B* it is mentioned that ***"location of ditch, swale, or headwall depends on the site condition but in no case within the limits of runway safety area (RSA)***." The width of the RSA, as specified in Appendix G of the *AC150/5300-13B* is 500 feet (152m).

2.15 Analysis of the runway excursion data collected for extended period of time revealed that 10 % veer-offs had gone beyond the graded portions of the runway strip, and few veering-off aircraft have covered up to **152 m** and on a rare occasion up to **210 m**.

2.16 As the consequences of runway excursions (runway veer-offs) may lead to undesirable consequences especially due to the presence of ill-designed and/ or injudicious location of such open-air storm water conveyance system, AP-ADO/TF/5 discussed the need for specifying the distance of open-air storm water conveyance from runway centerline and guidance for CAA for such assessment and inclusion in their national regulations, and guidelines for risk assessment and mitigation for existing open-air storm water conveyance which are unable to comply with the regulations.

2.17 AP-ADO/TF/5 noted that the Republic of Korea regulations required open air drains to be constructed beyond the non-graded portion of the runway strips and expressed the need for States to develop Policy and Procedures for accepting non-compliances based on safety risk assessment.

Application of Ultra-high Gravity wall in Altiports with High Fill Slope

2.18 AP-ADO/TF/5 noted China's experience in the application of ultra-high gravity wall in high fill slope engineering of China. Taking Wulong airport as the example, a gravity retaining wall, with 132.1m in length and maximum of 48.92 m in height, was constructed with reinforced concrete. The ultra-high gravity wall and the corresponding foundation were calculated with numerical simulation, and the deformation monitoring on-site was calculated. The results of the deformation monitoring demonstrated that the ultra-high gravity wall is applicable in the high fill slope engineering.

2.19 AP-ADO/TF/5 encouraged other APAC States to share their experience and difficulties in the treatment of the high fill slope.

Draft Regional Guidance for Design and Operations of Altiports

2.20 AP-ADO/TF/5 reviewed in detail the Draft Regional Guidance for Design *and Operations of Altiport* which was also posted separately on ICAO Meeting Webpage at https://www.icao.int/APAC/Meetings/Pages/AP-ADO-TF-5.aspx as **Attachment** to AP-ADO/TF/5-**WP/11**.

2.21 AP-ADO/TF/5 formulated the following Draft Decision for endorsement by AOP/SG/8 and consideration by APANPIRG/35 for approval of the Draft Final Document of the Regional Guidance for Design and Operations of Altiport prepared by the participating States of the AP-ADO/TF:

<table>
<tr><td colspan="3">Draft Decision AP-ADO/TF/5 – 4: Regional Guidance for Design and Operations of Altiports</td></tr>
<tr><td colspan="2">What: That, Regional Guidance for Design and Operations of Altiport developed by AP-ADO/TF (Appendix F to the AP-ADO/TF/5 Report) be endorsed by AOP/SG/8 for consideration by APANPIRG/35 for submission to Air Navigation Commission.</td><td>Expected impact:
☒ Political / Global
☐ Inter-regional
☒ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To submit the Draft Regional Guidance for review by the Ad hoc Working Group formed under Aerodrome Design and Operation Pannel (ADOP) to develop the Global Guidance on Design and Operations of Altiports.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 11 Dec. 2024</td><td colspan="2">Status: To be adopted by PIRG</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

Digital Auxiliary Technology for Airport Site Selection

2.22 AP-ADO/TF/5 noted that a digital auxiliary technology had been widely applied in China since 2018 for the site selection of hub airports represented by Foshan New Airport and Chongqing New Airport, and for the site selection of non-hub airport represented by Enshi Airport, Baicheng Airport, Jinzhai Airport, etc.

2.23 Traditional empirical airport site selection had some problems which contributed to long and subjective site selection cycle. By using digital auxiliary technology, the analyzed data is much larger, more comprehensive, more detailed, and more rapid, which improved the science, comprehensiveness and accuracy of site selection, and significantly shortened site selection cycle.

2.24 AP-ADO/TF/5 encouraged other APAC States/Administrations to share their experience in using digital auxiliary technology for airport site selection.

Task List of AP-ADO/TF

2.25 AP-ADO/TF/5 reviewed and updated the task list provided in **Appendix G** to the Report of the AP-ADO/TF/5.

2.26 The meeting noted that Workshop on Aerodrome Pavement Design and Evaluation including ICAO ACR-PCR Method of Reporting Pavement Strength would be conducted on 7 - 9 February 2024 at ICAO APAC, Bangkok, Thailand.

Enhancing Aviation Safety and Efficiency: Recommendation for Foreign Object Debris Detection Systems (FODDS)

2.27 AP-ADO/TF/5 noted that Association of Asia Pacific Airlines (AAPA) advocated the widespread adoption of Foreign Object Debris Detection Systems (FODDS) at major airports, emphasizing its proven benefits with mature technology.

2.28 FODDS, utilizing radar technology, enhances safety, reduces operational disruptions, and offers cost savings. FODDS should be promoted as standard equipment at airports with over 100,000 annual aircraft movements, recognizing their maturity and close to two decades of successful implementation.

2.29 ACI stated that while their association did not support mandating the installation of FODD for airports of all sizes, it did recommend that all airports, regardless of size and traffic density, should put in place an FOD management programme.

The Adoption of Annex 14 Recommended Practices as National Standards

2.30 Airport Council International (ACI) raised the issue of some regulators having the tendency of adopting ICAO Recommended Practices of Annex 14 as national standards without an adequate assessment of safety benefits. Examples of such practice were given including mandating a 240 m RESA intended for Code 3 and 4 aerodromes at smaller aerodromes. This would divert limited financial and human resources to expensive infrastructure works that could otherwise be invested in useful safety enhancements, such as training and facilities improvements.

2.31 AP-ADO/TF/5 recommended that States should consider consultation with aerodrome operators on the enactment of ICAO Annex 14 Recommended Practices as national standards and on proposed amendments to Annex 14 SARPs.

2.32 AP-ADO/TF/5 agreed to develop a regional guidance material and organize workshop on the transposition of Annex 14 SARPs, and organize workshop for States and aerodrome operators to share experience in the AGA audit area of USOAP CMA and included as a new task in its Task List.

Guidance on Risk Assessment for Lights with the Hazardous Effects

2.33 AP-ADO/TF/5 noted the need for guidance material to protect flight operations at airports from the potential hazards posed by non-aeronautical ground lights due to the rapid development of airport economic zones and hinterland complexes, coupled with the proliferation of high-intensity lighting devices such as LEDs and renewable power structures.

2.34 AP-ADO/TF/5 also noted that the Republic of Korea had been developing the risk assessment method, which includes three key evaluation indicators: Disability glare, Object recognition, and Identification interference.

2.35 AP-ADO/TF/5 agreed to develop guidelines for the Asia-Pacific region to protect flight operations at airports from the potential hazards posed by non-aeronautical ground lights and included it as a new task in its Task List.

Enhancing Aviation Safety and Efficiency: Recommendations for a More Risk Based Approach with Bird Strikes and Runway Closures

2.36 Association of Asia Pacific Airlines (AAPA) shared an avenue to enhance aviation safety and efficiency concerns, emphasizing the benefits of an enhanced use of a risk-based approach in determining runway closures arising from reported bird strikes. These measures are essential for minimizing disruptions, ensuring passenger safety, and enhancing overall airport operations. This enhanced aviation safety and efficiency emphasized the benefits of a risk-based approach to determine runway closures after bird strikes. This is essential for minimal disruptions, passenger safety, and improved airport operations.

2.37 The Secretariat invited AAPA to attend the Sixth Meeting of Asia and Pacific Wildlife Hazard Management Working Group (AP-WHM/WG/6) which would be held on 14 – 17 May 2024 in the ICAO APAC Office, Bangkok to present the WP related to the Wildlife Hazard Management.

Information Papers and Presentations

2.38 The following Information Papers and Flimsy were considered by AP-ADO/TF/5:

1) ICAO HQ Update on AGA Matters (IP/03);
2) Enhancement to Safety Management System: Management of Change Reporting Template (IP/04);
3) Sustainable Airport Pavement Management (IP/05);
4) Clarification on Annex 14 regarding strength of RESA and Runway strip as per Aerodrome Design Manual (ADM) Doc 9157 Part 3, Pavements (Third Edition, 2022) (Flimsy/01)

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) review the Summary Report (**Attachment A**) on the Fourth Meeting of AP-ADO/TF;
b) review the **Draft Conclusion** presented in Paragraph 2.4, 2.8 & 2.12 for endorsement by AOP/SG/8 and further consideration by APANPIRG/35;
c) review the **Draft Decision** presented in Paragraph 2.21 for adoption by AOP/SG/8; and
d) discuss any relevant matters as appropriate.

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INTRODUCTION

1. Meeting

1.1 The Fifth Meeting of Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/5) was held in Wanasawan Meeting Room, Mae Fah Luang University, Chiang Rai, Thailand from 30 January to 2 February 2024.

2. Attendance

2.1 62 participants from 14 Member States, 3 International Organization attended the Meeting.

3. Language and Documentation

3.1 The working language of the meeting and all documentation were in English. There were 19 Working Papers, 5 Information Papers and 1 Flimsy considered by the Meeting.

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Agenda Item 1: Adoption of Provisional Agenda (WP/01)

The Provisional Agenda was adopted by the Meeting without amendment.

Agenda Item 1:	Adoption of Provisional Agenda
Agenda Item 2:	Review Outcome of Relevant Meetings
Agenda Item 3:	Regional Air Navigation Plan, Part II, Tables AOP I-1 & II-1 and Asia/Pacific Seamless ANS Plan
Agenda Item 4:	Planning, Design and Construction of Aerodromes
Agenda Item 5:	Asia and Pacific Regional Guidance on Design and Operation of Altiports
Agenda Item 6:	Airport Innovation
Agenda Item 7:	AP-ADO/TF Task List
Agenda Item 8:	Any other business • Adoption of Annex 14 Recommendations as National Standards
Agenda Item 9:	Provisional Agenda, Date and Venue for the Next Meeting

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Agenda Item 2: Review Outcome of Relevant Meetings

Action Items of 58th Conference of Directors General of Civil Aviation (WP/2)

2.1 AP-ADO/TF/5 meeting reviewed the action items of 58th Conference of Directors General of Civil Aviation (DGCA/58, Dhaka, Bangladesh, 15 to 19 October 2023) relevant to aerodrome design and operations.

Discussion Paper	Action Item	Description
Agenda Item 3: Aviation Safety		
DP/3/03	58/4	To ensure efficient and safe ground operations and prevent incidents and accidents, the Conference: a) Encouraged States/Administrations, International Organizations, Industries and Safety Partners to share their best practices, technologies, and procedures related to aircraft handling, apron management and ground support equipment for enhancing safety Standards; and b) Requested ICAO to continue assistance to the States/Administrations through Guidance Material, seminars, workshops, and training on Runway safety and Wildlife Hazard Management.
DP/3/19 DP/4/11	58/15	To facilitate the safe and efficient deployment of autonomous vehicles (AVs) at the airside, the Conference encouraged: a) States/Administrations to share the experience and information about AV trials and operations at the airside; and b) ICAO to consider the development of guidance materials and/or SARPs, as necessary.
DP/3/20	58/16	Noting the efforts in strengthening and supporting the safety management of ground handling in the region, the Conference encouraged States/Administrations and industry stakeholders to share their activities and challenges in the safety management of ground handling.
Agenda Item 6: Economic Development of Air Transport		
DP/6/06	58/33	To support safe, secure, efficient, and sustainable mobility solutions and harmonised standards, certifications, policy and framework to regulate the Advanced Air Mobility (AAM) sector, the Conference encouraged States/Administrations to consider AAM operations in airport master planning, undertake dialogue between all relevant stakeholders, and participate in the first ICAO Advanced Air Mobility Symposium (AAM 2024) from 9 to 12 September 2024, in Montreal, Canada.
Agenda Item 7: Aviation and Environment		
DP/7/05	58/36	To reduce operation and maintenance costs, improve the safety and efficiency of operations, and reduce environmental impacts associated with implementing approach lighting systems at airports in mountainous and waterfront locations, the Conference encouraged States/Administrations to consider implementing the prefabricated approach lighting system bridge and suggested that ICAO refer the paper to the Visual Aids Working Group of Aerodrome Design and Operations Panel (ADOP) for consideration.

Agenda Item 9: Updates		
DP/9b/01	58/43	The Conference encouraged States/Administrations to collaborate and work towards achieving the commitments of the Beijing Declaration and share implementation status with the ICAO Asia-Pacific Office to further report to the Second Asia Pacific Ministerial Conference on Civil Aviation in India in 2024.

2.2 AP-ADO/TF/5 meeting reminded States/Administrations to take necessary actions in accordance with 58th DGCA Conference Action Items.

Relevant Outcomes of APANPIRG/34 (WP/03)

2.3 WP/03 provided a summary of the outcomes of the 34th Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/34) which was held in Hong Kong, China from 11 to 13 December 2023.

2.4 AP-ADO/TF/5 acknowledged that APANPIRG/34 had adopted the following Conclusions related to aerodrome design and operations:

i) *Conclusion APANPIRG/34/3: Runway Turn Pad Design and Marking;*

ii) *Conclusion APANPIRG/34/4: ICAO Asia-Pacific Aerodrome Assistance Go-Team Methodology;*

iii) *Conclusion APANPIRG/34/5: ICAO Asia/Pacific WHM Go-Team Methodology;* and

iv) *Conclusion APANPIRG/34/16 – Update of Information in APANPIRG Air Navigation Deficiencies Reporting Form.*

2.5 The Final Report of APANPIRG/34 published at https://www.icao.int/APAC/Meetings/Pages/2023-APANPIRG-34.aspx provided the detailed descriptions of the above Conclusions.

2.6 AP-ADO/TF/5 noted that at APANPIRG/34 AOP Chairman highlighted the following challenges in AOP fields and prioritization for 2024 AOP/SG Work Programme:

a) Implementation of GRF in APAC Region: As of 2023, only 15 States implemented GRF.

b) Implementation of Aircraft classification rating-pavement classification rating (ACR-PCR) method of reporting bearing strength of aerodrome pavements: Applicable as of 28 November 2024.

c) Training on proposed new obstacle limitation surfaces.

d) Guidance and training in aeronautical studies.

e) Safety management of ground handling services.

f) Improvement of APAC USOAP EI in AGA from 61.2% (June 2023) to GASP 2022 – 2025 Target of 75%.

2.7 AP-ADO/TF/5 encouraged States/Administrations to host ICAO APAC Aerodrome Assistance Go-Team and/or WHM Go-Team assistance missions if they need assistance in Aerodromes and Ground Aids including certification and surveillance of aerodromes and/or WHM areas.

Relevant Outcomes of AOP/SG/7 (WP/04)

2.8 The Secretariat presented the outcomes of the Seventh Meeting of the Aerodromes Operations and Planning Sub-group (AOP/SG/7, 3 to 6 July 2023, Bangkok, Thailand) relevant to aerodrome design and operations.

2.9 AP-ADO/TF/5 acknowledged that the following regional guidance materials developed by the Asia/Pacific Aerodrome Assistance Working Group had been approved by AOP/SG/7:

i) *Generic Aerodrome Enforcement Policy and Procedures Manual*;

ii) *Generic Aerodrome Exemptions Policy and Procedures Manual*; and

iii) *Generic Aerodrome Inspector Handbook, Revision 1, 2023.*

and all documents had been published on the ICAO Asia/Pacific Regional Office eDocuments webpage: https://www.icao.int/APAC/Pages/eDocs.aspx under AGA heading.

2.10 AP-ADO/TF/5 also acknowledged that the AOP/SG/7 had adopted five Decisions as below:

i) Decision AOP/SG/7-2: Proposal for Amendment to AP-ADO/TF's TOR

ii) Decision AOP/SG/7-7: Proposal for Amendment to AP-AA/WG's TOR

iii) Decision AOP/SG/7- 8: Updated List of Asia/Pacific Generic Guidance Materials Developed by the AP-AA/WG with Details of the Custodians

iv) Decision AOP/SG/7-9: Proposal for Amendment to AP-WHM/WG's TOR

v) Decision AOP/SG/7-11: Adoption of Annex 14 Recommendations as National Standards

2.11 The Final Report of AOP/SG/7 published at https://www.icao.int/APAC/Meetings/Pages/2023-AOP-SG7.aspx provided the detailed descriptions of the above Conclusions.

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Agenda Item 3: Regional Air Navigation Plan, Part II, Tables AOP I-1 & II-1 and Asia/Pacific Seamless ANS Plan

Asia/Pacific Air Navigation Plan (WP/05)

3.1 The Secretariat presented the structure of the Asia/Pacific Air Navigation Plans (APAC ANPs) and the procedures for the amendment of these Plans. All three Volumes of Asia/Pacific Air Navigation Plan and the template of Proposal for Amendments (PfA) to APAC ANPs provided at https://www.icao.int/APAC/Pages/APAC-eANP.aspx.

3.2 States and Administrations were reminded of the following items when preparing the Proposal for Amendment to Table AOP II-1 of APAC ANP Volume II:

a) the required level of protection expressed by means of an aerodrome rescue and firefighting (RFF) category number, determined in accordance with *Annex 14, Volume I, 9.2*, would be provided under column 2;

b) changes in the level of protection normally available at an aerodrome for RFF should not be detailed in this Table, but should be notified to the appropriate air traffic services unit and aeronautical information services units, in accordance with *Annex 14, Volume I, 2.11.3* and *2.11.4*. Further guidance is available in *ICAO Doc 9137 Airport Services Manual, Part 1 – Rescue and Firefighting, Chapter 16*;

c) the aerodrome reference code (RC) selected for aerodrome planning purposes in accordance with *Annex 14, Volume I, 1.6* should be provided under column 3; and

d) the critical design aircraft selected for determining RC, RFF category and pavement strength should be provided under column 6. Only one critical aircraft type should be shown, if it was used to determine all three elements. Otherwise, different critical aircraft types should be shown for different elements.

3.3 AP-ADO/TF/5 recalled the Conclusion APANPIRG/33/1 adopted by APANPIRG/33 (22 to 24 November 2022, Bali Indonesia):

Conclusion APANPIRG/33/1: Proposal for Amendment to Asia/Pacific ANP Volume I, Table AOP I-1 and ANP Volume II, Table AOP II-1

That, Asia Pacific States/Administrations are urged to:

a) review the aerodromes listed in APAC ANP Volume I, Table AOP I-1;

b) review the ANP Volume II, Table AOP II-1 for the list of facilities and services to be provided by the State concerned at each aerodrome that is listed in Table AOP I-1; and

c) *initiate and send to ICAO APAC Office proposals for amendment to APAC ANP Volume I, Table AOP I-1 and ANP Volume II, Table AOP II-1 in accordance with the template provided in* ***Appendix B to the Report on Agenda Item 3.1****, if their international aerodromes are not yet listed in Table AOP I-1 or require any amendments to update the information provided in Tables AOP I-1 and AOP II-1.*

3.4 AP-ADO/TF/5 was informed that APAC Office had completed processing of PfAs for six States/Administrations (Bhutan, Japan, Republic of Korea, Samoa, Thailand and Viet Nam) in 2023 and APAC ANP Volumes I & II had been amended accordingly.

3.5 AP-ADO/TF/5 noted that among 355 international aerodromes in Asia and Pacific Regions only 282 international aerodromes had been listed in Asia/Pacific Region ANP Volume I by 2023. The detailed information of aerodromes yet to be listed in APAC ANP by Asia Pacific States/Administrations provided in **Appendix A** to the AP-ADO/TF/5 Report.

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Agenda Item 4: Planning, Design and Construction of Aerodromes

Inconsistency Requirement in ICAO Annex 14 Volume I (WP/06)

4.1 Presented by Malaysia the WP/06 highlighted the inconsistency observed in ICAO Annex 14 Volume I requirements and additional information collated from other guidance material (ICAO Aerodrome Design Manual Part 4, ACI Handbook and FAA's safety study) for discussion. The inconsistency identified in Annex 14 Volume I related to some requirements in Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe, Pavement Edge Flushing, and Precision Approach Lighting were discussed for clarification as below:

Taxiway Centerline Marking

4.2 Annex 14 Vol 1 Standard 5.2.1.3 specifies that "at an intersection of a runway and taxiway the markings of the runway shall be displayed, and the markings of the taxiway interrupted, except that runway side stripe markings may be interrupted". The Meeting discussed whether taxiway centerline markings should be allowed to interrupt other runway markings such as aiming point marking, touchdown zone marking, and threshold marking (for taxiway centerline and turn pad marking) after considering the fact that the size of all those three (3) marking is large and by locating taxiway centreline markings below them, the pattern of the taxiway centreline markings may be compromized.

4.3 After discussion, AP-ADO/TF/5 recommended that further deliberation on this item would be required within the Visual Aids Working Group.

Threshold Marking

4.4 AP-ADO/TF/5 discussed the discrepancy of the commencement of threshold marking to the edge of threshold as mentioned in 5.2.4.4 with the value stated in Figure 5.2 in Annex 14 Vol 1. Clarification is needed to determine whether the requirement is a minimum of 6 meters (as mentioned in Figure 5.2) or if it must be precisely 6 meters as mentioned in clause 5.2.4.4.

4.5 After deliberation, AP-ADO/TF/5 agreed to forward this item to the Visual Aids Working Group.

Taxiway Traverse Stripe

4.6 ICAO ADM Part 4, Clause 2.2.3 recommends the transverse stripe marking extend to within 1.5 m of the outside edge of the stabilized paving or be 7.5 m long, whichever is shorter. The statement is found to be a little bit confusing and may result in different interpretation by different parties. Moreover, some States had implemented markings and signs based on ACI Handbook on Apron Markings and Signs. ACI Handbook recommends a maximum distance of 1.5 meters for transverse stripes on low-strength shoulders.

4.7 After discussion, AP-ADO/TF/5 recommended further deliberation on this item within the Visual Aids Working Group.

Flush of Pavement Edge with strip

4.8 Annex 14, Volume I, Standard 3.4.10 requires that "The surface of that portion of a strip that abuts a runway, shoulder or stopway shall be flush with the surface of the runway, shoulder or stopway". However, Annex 14, Volume I does not specifically mention the tolerance on how many inches allowed between the two different surfaces.

4.9 The safety study conducted by US FAA suggested that a tolerance of 3 inches is acceptable. Consequently, FAA had adopted the requirement as follows: "The pavement edges must not exceed a difference of 3 inches in elevation between abutting pavement sections and between pavement and abutting areas”.

4.10 AP-ADO/TF/5 noted that some States in Asia and Pacific Region adopted the flush tolerance of 1 inch to 3 inches. The AAPA representative expressed their view that the impact on aircraft nosewheel due to unflushed surfaces may vary depending on the aircraft type.

4.11 The Republic of Korea, Pakistan, and Australia supported the Working Paper and AP-ADO/TF/5 endorsed the need for further deliberation on this matter within the Aerodrome Design Working Group.

Precision Approach Light

4.12 It was observed that there is a discrepancy between longitudinal intervals of Precision Approach Light Cat I mentioned in Annex 14 Volume I Clause 5.3.4.12 and Figure A – 8 of Attachment A of the same document. Annex 14 Volume I Clause 5.3.4.12 states that the lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold. While in Attachment A, Figure A – 8 allows significant tolerances between the crossbars (± 6 m). AAPA representative has emphasized the importance of the crossbar, as pilots rely on visual cues, especially during low visibility conditions.

4.13 After discussion, AP-ADO/TF/5 recommended further deliberation on this item within the Visual Aids Working Group.

4.14 Considering the inconsistency observed in Annex 14 Volume I and need for clarification in the above five areas, AP-ADO/TF formulated the following Draft Conclusion for adoption by AOP/SG/8:

<table>
<tr><td colspan="3">Draft Conclusion AP-ADO/TF/5 – 1: Inconsistency Requirements in ICAO Annex 14 Volume I (Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe, Pavement Edge Flushing, and Precision Approach Lighting)</td></tr>
<tr><td colspan="2">What: That, ICAO HQ should be consulted on the inconsistency in and conflicting ICAO Annex 14 Volume I requirements (Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe, Pavement Edge Flushing, and Precision Approach Lighting) identified in AP-ADO/TF-WP/06 (Appendix B to the AP-ADO/TF/5 Report) for further deliberation at the respective Working Groups (such as, Visual Aids Working Group and Aerodrome Design Working Group).</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: States to establish clear standard and recommended practices (SARPs) on Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe, Pavement Edge Flushing, and Precision Approach Lighting for enhancing safety and efficiency.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 19 July 24</td><td colspan="2">Status: Adopted by Subgroup</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

Safety Risk Warnings Related to The Temporary Ramp of The Runway Pavement Overlay (WP/07)

4.15 Presented by China, WP/07 shared China's experience in runway overlay projects where they had embedded the foot of the temporary ramp with a longitudinal slope of 1% into the existing pavement through milling into grooves. This method enhanced the stability of the temporary ramp and reduced the risk of FOD.

4.16 Regarding China's proposal to the ICAO for the revision of the longitudinal slope of the temporary ramp to 1%, some States expressed that they need to consult with their aerodrome operators and more research on this subject.

4.17 ADO/TF/5 accepted China's proposal to request ICAO APAC Office to circulate the questionnaire (**Appendix C**) with a State Letter to APAC States/Administrations for feedback on their use of temporary ramp in runway overlay projects.

Review on the Color Shift Characteristics in Relation to the Photometric Testing Requirements Pertaining to the Aeronautical Ground Lighting Systems using Solid State Lighting (LED) (WP/08)

4.18 Presented by India, the WP/08 highlighted the study on the importance of the colour aspects of the Aeronautical Ground Lighting (AGL) system. With the evolution of LED technology, several aspects of operational and maintenance have undergone a change. With the long-life span of the LED lighting the operational intervention reduced considerably and the chromaticity diagram for solid-state lighting with change in the boundaries in the colour had been introduced. The paper discussed the importance of colour which is one of the 4Cs of the AGL system, an important parameter which when gone unnoticed could lead to non- compliance of the AGL system.

4.19 LEDs emit the required colour directly using the required semi-conductors. While the probability of colour shift being a common parameter in the LED which happens due to the improper selection of the materials, high junction temperatures and the construction of the fixture. Due to its long life span the shift may go unnoticed. As per the regulatory standards the photometric measurement of beam spread and intensity should be measured for the precision approach CAT II and CAT III facilities, while the paper proposed to include colour parameter also as part of measurement as a recommendation. In addition, the relevant clauses from ADM Part 4 and Annex 14 provisions on the colour measurement were presented to the Task Force. This gave the trend of the colour shift if any, year on year and helps the airport and the regulators to ensure compliance with the national requirements.

4.20 In response to the question on an additional financial burden to the aerodrome operators, India responded that this would be applicable for the Airports having CAT II/III facilities and having LED lighting system. Moreover, the main objective was to collect the data, and this could be done on a sampling basis. Manufacturers could be able to easily have the colour sensors which would be of very less cost and equipment such as chromometers, available at affordable prices, could be used for sampling measurement in no time.

4.21 Australia, India, the Republic of Korea and Thailand supported the WP/08 and acknowledged the benefit in including colour in the national requirements (as recommendations) to protect the interest of the Airports and the regulator for ensuring the 4C's compliance of the AGL system. Australia furthermore commented that lower capability aerodromes may however face challenges with the conduct of technical measurements to detect any colour shifts with installed solid state (LED) AGL units, beyond general observations as to their serviceability.

4.22 Acknowledging the benefit highlighted in Paragraph 4.21, AP-ADO/TF/5 agreed to refer to the Visual Aids Working Group the WP/08 for further deliberation and formulated the following Draft Conclusion for consideration by AOP/SG/8:

<table>
<tr><td colspan="3">Draft Conclusion AP-ADO/TF/5 – 2: Proposal for Amendment to 10.5.3 to 10.5.5 of Annex 14, Volume I for inclusion of the colour measurement</td></tr>
<tr><td colspan="2">What: That, ICAO Visual Aids Working Group is requested to review AP-ADO/TF/5 – WP/08 for consideration of the inclusion of the requirement for colour measurement as recommended in the WP/08 (Appendix D to the AP-ADO/TF/5 Report) in 10.5.3 to 10.5.5 of Annex 14, Volume I.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To protect the interest of the airports and the aviation regulator for ensuring the 4C’s compliance of the AGL system.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 19 July 2024</td><td colspan="2">Status: Adopted by Subgroup</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

<u>Review on the Requirement of the Runway Guard Lights Provision when Stop Bars are available and Recommendations on the Stop Bar Operation Sequence Timings (WP/09)</u>

4.23 Presented by India, the WP/09 reviewed the requirement of the runway guard lights provision and the dependency of the stop bar lighting at Airports when operated under different operational conditions. As per the ICAO Annex 14, Volume I SARPs the runway guard lights are provided where stop bars are not installed or operated when RVR conditions are less than 550 m. The paper discussed the proposed recommendations on the safety and operational aspects of the stop bar sequence of operations in conjunction with the provision of the runway guard lights. Furthermore, the clarification on the need for providing the runway guard lights in different RVRs as per the regulatory standards in different conditions had been evaluated and provided accordingly.

4.24 The paper key concept is associated with the stop bar operations functioning with timer operations. During a specific phase when stop bar is OFF and the taxiway centreline lights (TCLs) after the runway holding position are ON and this state continues to function for a period of 30 sec to 90 sec, in which the runway holding position cannot be identified clearly when RVR conditions are less than 550 m. In such conditions, considering the operational and safety requirements, the airports may install runway guard lights in addition to the stop bars, which could be considered as recommended practices, as proposed in this paper.

4.25 In addition, the aspects of provision of runway guard lights when RVR in range of 550-1200 m when stop bar is installed, was proposed as a recommendation in this paper. As the standards have not referred any guidance on RVR conditions greater than 1200 m, the same has been proposed as a recommendation for providing the runway guard lights. It is suggested to follow based on the need and safety study.

4.26 After deliberation, AP-ADO/TF/5 recommended that this working paper to be sent to the Visual Aids Working Group for further deliberation and formulated the following Draft Conclusion for consideration by AOP/SG/8:

<table>
<tr><td colspan="3">Draft Conclusion AP-ADO/TF/5 – 3: Review on the Requirement of the Runway Guard Lights Provision when Stop Bars are available and Recommendations on the Stop Bar Operation Sequence Timings</td></tr>
<tr><td colspan="2">What: That, ICAO Visual Aids Working Group is requested to review AP-ADO/TF/5 – WP/09 for consideration of recommendations made in the WP/09 in Section 5.1 b) and c) (Appendix E to the AP-ADO/TF/5 Report) regarding runway guard lights</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To enhance runway safety through operations of runway guard lights as part of effective runway incursion prevention measures in all visibility or weather conditions.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 19 July 2024</td><td colspan="2">Status: Adopted by Subgroup</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

Open-Air Storm Water Conveyance in Runway Strip (WP/20)

4.27 WP/20 highlighted the ICAO Annex 14, Volume I SARPs and ADM (Doc 9157), Part 1 regarding the location of open-air storm water conveyance at the non-graded portion of a runway strip and the risks associated with it during runway excursions. The SARPs and guidance material echoed the same intent that these open-air drains should be designed and constructed as far as possible away from the runway. Though the information is given in the Note -1 of RP 3.4.16, the note itself does not constitute as a part of RP 3.4.16. Therefore, the application of the Note-1 has been left to the judgement of the aerodrome planners.

4.28 The WP/20 provided an example of the FAA advisory circular: AC150/5300-13B where it reads, "*location of ditch, swale, or headwall depends on the site condition* ***but in no case within the limits of runway safety area (RSA)***." The width of the RSA, as specified in Appendix G of the AC is 500 feet (152m).

4.29 The paper also provided analysis of the runway excursion data collected for extended period of time which suggested that 90% of the runway veer-offs were arrested within the graded portions of the runway strip. However, the remaining 10 % veer-offs had gone beyond the graded portions. Analysis suggested that these few veering-off aircraft have covered up to 152 m and on a rare occasion up to 210 m.

4.30 As the consequences of these rare occasions may lead to undesirable consequences especially due to the presence of ill-designed and/ or injudicious location of such open-air storm water conveyance system, AP-ADO/TF/5 discussed the need for specifying the distance of open-air storm water conveyance from runway centerline and guidance for CAA for such assessment and inclusion in their national regulations, and guidelines for risk assessment and mitigation for existing open-air storm water conveyance which are unable to comply with the regulations,

4.31 The Republic of Korea supported the Working Paper and shared that their regulations required open air drains to be constructed beyond the non-graded portion of the runway strips and expressed the need for States to develop Policy and Procedures for accepting non-compliances based on safety risk assessment.

ICAO HQ Update on AGA Matters (IP/03)

4.32 IP/03 presented information related to aerodrome activities carried out recently in the Airport Operations and Infrastructure section, Air Navigation Bureau, ICAO Montreal.

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Agenda Item 5: Asia and Pacific Regional Guidance on Design and Operation of Altiports

Application of Ultra-high Gravity wall in Altiports with High Fill Slope (WP/10)

5.1 Presented by China WP/10 shared China's experience in the application of ultra-high gravity wall in high fill slope engineering of China. Taking Wulong airport as the example, a gravity retaining wall, with 132.1m in length and maximum of 48.92 m in height, was constructed with reinforced concrete. The ultra-high gravity wall and the corresponding foundation were calculated with numerical simulation, and the deformation monitoring on-site was calculated. The results of the deformation monitoring demonstrated that the ultra-high gravity wall is applicable in the high fill slope engineering.

5.2 Other methods on the treatment of high fill slope, such as the loading berm, slab-pile wall and reinforced retaining wall, were reviewed. AP-ADO/TF/5 encouraged other APAC States to share their experience and difficulties in the treatment of the high fill slope.

5.3 The Republic of Korea and Nepal supported the Working Paper. ACI appreciated China for sharing its experience in the application of ultra-high gravity wall in high fill slope engineering of China to the Task Force Members and requested China to share such experiences in future aerodrome seminars.

Draft Regional Guidance for the Design and Operations of Altiports (WP/11)

5.4 China, Fiji, India, Indonesia and Nepal prepared and presented the final draft of the Regional Guidance for Design and Operations of Altiport.

5.5 It was noted that altiports in the mountainous areas for the operation of aircrafts with short take-off and landing (STOL) performances defy the standards and recommended practices of Annex 14, Aerodromes, Volume I – Aerodrome Design and Operations as well as guidelines provided in Stolport Manual (Doc 9150) due to topographical challenges and financial constraints, especially in terms of steep longitudinal slope, inadequate runway strip, infringement by obstacles etc. Furthermore, there were no specific international and globally harmonized guidelines for design, construction and operations of altiports.

5.6 The AP-ADO/TF/5 Meeting reviewed in detail the Draft Regional Guidance for Design and Operations of Altiport. The Draft Regional Guidance for Design and Operations of Altiport is provided in **Appendix F** to this Report for further comments by the Members of the Task Force, if any.

5.7 Papua Neu Guinea suggested to distinguish markers to be used for unpaved runway and runway strips. China suggested to consider apron design from operational safety and maintenance perspective. The Republic of Korea appreciated the participating States for their hard work in drafting the Regional Guidance Materials.

5.8 The Meeting requested the participating States to finalize the Regional Guidance for Design and Operations of Altiport before 31 May 2024 for submission to AOP/SG/8 for endorsement and consideration by APANPIRG/35. AP-ADO/TF/5 formulated the following Draft Decision:

Draft Decision AP-ADO/TF/5 – 4: Regional Guidance for Design and Operations of Altiports	
What: That, Regional Guidance for Design and Operations of Altiport developed by AP-ADO/TF (**Appendix F** to the AP-ADO/TF/5 Report) be endorsed by AOP/SG/8 for	Expected impact: ☒ Political / Global ☐ Inter-regional

consideration by APANPIRG/35 for submission to Air Navigation Commission.		☒ Economic ☐ Environmental ☒ Ops/Technical
Why: To submit the Draft Regional Guidance for review by the Ad hoc Working Group formed under Aerodrome Design and Operation Pannel (ADOP) to develop the Global Guidance on Design and Operations of Altiports.	Follow-up: ☐Required from States	
When: 11 Dec. 2024	Status: Adopted by PIRG	
Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX		

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Agenda Item 6: Airport Innovation

Digital Auxiliary Technology for Airport Site Selection (WP/12)

6.1 China presented the WP/12 which introduced digital auxiliary technology for airport site selection. It has been widely applied in China since 2018, including site selection for hub airport represented by Foshan New Airport and Chongqing New Airport, and site selection for non-hub airport represented by Enshi Airport, Baicheng Airport, Jinzhai Airport, etc.

6.2 Traditional empirical airport site selection had some problems which contributed to long and subjective site selection cycle. By using digital auxiliary technology, the analyzed data is much larger, more comprehensive, more detailed, and more rapid, which improves the science, comprehensiveness and accuracy of site selection, and significantly shortens site selection cycle.

6.3 AP-ADO/TF/5 encouraged other APAC States/Administrations to share their experience in using digital auxiliary technology for airport site selection.

6.4 The Republic of Korea supported the WP/12.

Enhancement to Safety Management System: Management of Change Reporting Template (IP/04)

6.5 IP/04 presented the enhancement of Management of Change reporting template; one of the Safety Management System elements to ease the report writing by line manager as a mean to assimilate the implementation of SMS into daily task.

6.6 The focus of the enhancement was on the end user challenges in producing the management of change report. Hence the enhancement made were guided reporting format with brief description on details required and guidance note on the next steps required. The reporting format was arranged with the management of change requirements which eventually forming a report that could be directly submitted to State and Safety Office.

6.7 The paper requested the Meeting to note on the information shared and encouraged member States/Administrations to share their knowledge and experience on innovation made to the element of Safety Management System.

Sustainable Airport Pavement Management (IP/05)

6.8 The Republic of Korea presented IP/05, including 3-key sustainable airport pavement management practices (Echelon pavement, Trapezoid groove, Extension of rigid pavement) to strengthen runway safety considering climate change. The meeting discussed relevant matters.

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Agenda Item 7: AP-ADO/TF Task List

Task List of AP-ADO/TF (WP/13)

7.1 WP/13 provided the task list of AP-ADO/TF for review and update by the meeting.

7.2 The meeting noted that Workshop on Aerodrome Pavement Design and Evaluation including ICAO ACR-PCR Method in Reporting Pavement Strength would be conducted on 7 - 9 February 2024 at ICAO APAC, Bangkok, Thailand.

7.3 The meeting updated the task list of AP-ADO/TF and the updated task list provided in **Appendix G**.

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Agenda Item 8: Any other business

Enhancing Aviation Safety and Efficiency: Recommendation for Foreign Object Debris Detection Systems (FODDS) (WP/14)

3.2 WP/14 presented by Association of Asia Pacific Airlines (AAPA) advocated the widespread adoption of Foreign Object Debris Detection Systems (FODDS) at major airports, emphasizing its proven benefits with mature technology.

3.3 FODDS, utilizing radar technology, enhances safety, reduces operational disruptions, and offers cost savings. FODDS should be promoted as standard equipment at airports with over 100,000 annual aircraft movements, recognizing their maturity and close to two decades of successful implementation.

3.4 Malaysia informed the Meeting that they have implemented FODDS at Kuala Lumpur International Airport. Airports often may face challenges in decision making for selecting FODDS due to limited numbers of manufacturing companies and introduction of FODDS at relatively small number of major airports in Asia and Pacific Region.

3.5 ACI stated that while their association did not support mandating the installation of FODD for airports of all sizes, it did recommend that all airports, regardless of size and traffic density, should put in place an FOD management programme.

The Adoption of Annex 14 Recommended Practices as National Standards (WP/15)

3.6 WP/15 presented by the Airport Council International (ACI) raised the issue of some regulators having the tendency of adopting ICAO Recommended Practices of Annex 14 as national standards without an adequate assessment of safety benefits. Examples of such practice were given including mandating a 240 m RESA intended for Code 3 and 4 aerodromes at smaller aerodromes. This would divert limited financial and human resources to expensive infrastructure works that could otherwise be invested in useful safety enhancements, such as training and facilities improvements, the paper asserted.

3.7 The paper recommended that States should consider consultation with aerodrome operators on the enactment of ICAO Annex 14 Recommended Practices as national standards. On a related issue, the paper also encouraged States to consult with aerodrome operators on proposed amendments to Annex 14 SARPs. Furthermore, the paper recommended that ICAO develop regional guidance materials and organize workshops on the transposition of Annex 14 SARPs, and organize workshops for States and aerodrome operators to share experience in the AGA audit area of USOAP CMA.

3.8 Majority of the Taks Force Member supported ACI paper and AP-ADO/TF/5 endorsed recommendations made by ACI and included as new tasks in the Task List (**Appendix G**).

Guidance on Risk Assessment for Lights with The Hazardous Effects (WP/16)

3.9 The Republic of Korea presented WP16, addressing the need for guidance material to protect flight operations at airports from the potential hazards posed by non-aeronautical ground lights due to the rapid development of airport economic zones and hinterland complexes, coupled with the proliferation of high-intensity lighting devices such as LEDs and renewable power structures.

3.10 WP/16 also outlined the risk assessment method being prepared by the Republic of Korea, which includes three key evaluation indicators: Disability glare, Object recognition, and Identification interference.

3.11 The Disability glare being a quantitative indexing of glare (cd/m²), while Object recognition measures the degree of change in object recognition according to the disability glare index (%).

3.12 Identification interference measures the degree of interference in identification of aeronautical lights. The results of the risk assessment would be categorized into high risk, risk management required, and low risk, and ground regulations would be prepared to establish and operate a committee for the verification procedure of risk assessment results.

3.13 The Republic of Korea called on member States/Administrations in the Asia-Pacific region to collaborate in fostering a robust framework for enhancing airport safety and preserving the integrity of flight operations through global cooperation.

3.14 AP-ADO/TF/5 agreed to develop guidelines for the Asia-Pacific region to protect flight operations at airports from the potential hazards posed by non-aeronautical ground lights and included it as a new task in its Task List.

Enhancing Aviation Safety and Efficiency: Recommendations for a More Risk Based Approach with Bird Strikes and Runway Closures (WP/17)

3.15 WP/17 presented by Association of Asia Pacific Airlines (AAPA), addressing an avenue to enhance aviation safety and efficiency concerns, emphasizing the benefits of an enhanced use of a risk-based approach in determining runway closures arising from reported bird strikes. These measures are essential for minimizing disruptions, ensuring passenger safety, and enhancing overall airport operations. This enhanced aviation safety and efficiency emphasizes the benefits of a risk-based approach to determine runway closures after bird strikes. This is essential for minimal disruptions, passenger safety, and improved airport operations.

3.16 ACI and the Republic of Korea supported the WP, in particular, the risk based approach for runway closures.

3.17 The Secretariat invited AAPA to attend the Sixth Meeting of Asia and Pacific Wildlife Hazard Management Working Group (AP-WHM/WG/6) which would be held on 14 – 17 May 2024 in the ICAO APAC Office, Bangkok to present the WP related to the Wildlife Hazard Management.

Clarification on Annex 14 regarding strength of RESA and Runway strip as per Aerodrome Design Manual (ADM) Doc 9157 Part 3, Pavements (Third Edition, 2022) (Flimsy/01)

3.18 India presented Annex 14, Volume I provision related to the strength of runway strip (para 3.4.17 refers) and RESA (para 3.5.12 refers) and reference to 5.3.26 of ADM, Part 1 for the same. It was noted that the earlier edition of ICAO Aerodrome Design Manual, Part 3 (Edition 1983) did not contain any guidance on design of unpaved surfaces and therefore the reference of only ADM Part 1 was included in Annex 14.

3.19 ADM, Part 3 (Third Edition, 2022) in its Chapter 9 provides guidance on structural criteria for unpaved areas such as runway and taxiway shoulders, runway end safety areas (RESAs) and runway strips (Paras 9.3 and 9.4.2 refer).

3.20 The Secretariat informed the Meeting that he would forward the materials presented by India to the ICAO HQ for clarification which guidance to be used for the strength of the runway strip and RESA.

List of Experts for AP-ADO-TF (IP/02)

3.21 The Secretariat presented the IP/02 and requested the Members of the Task Force to provide names and details of the AGA Experts for updating the List.

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Agenda Item 9: Provisional Agenda, Date and Venue for the Next Meeting

Provisional Agenda, Date and Venue of Next Meeting (WP/19)

9.1 AP-ADO/TF/5 reviewed the draft agenda proposed by the Secretariat and agreed on the following Provisional Agenda for the AP-ADO/TF/6:

AP-ADO/TF/5

PROVISIONAL AGENDA

Agenda Item 1:	Adoption of Provisional Agenda
Agenda Item 2:	Review Outcome of Relevant Meetings
Agenda Item 3:	Regional Air Navigation Plan, Part II, Tables AOP I-1 & II-1 and Asia/Pacific Seamless ANS Plan
Agenda Item 4:	Planning, Design and Construction of Aerodromes
Agenda Item 5:	Asia and Pacific Regional Guidance on Design and Operations of Altiports
Agenda Item 6:	Airport Innovation
Agenda Item 7:	AP-ADO/TF Task List
Agenda Item 8:	Any other business
Agenda Item 9:	Provisional Agenda, Date and Venue for the Next Meeting

9.2 The next AP-ADO/TF Meeting would be held in January/February 2025 for four days. The venue proposed was ICAO APAC Office, Bangkok; however, State/Administration interested to host the meeting was requested to contact the Secretariat. The venue of the meeting would be communicated to States/Administrations through ICAO APAC Invitation Letter for AP-ADO/TF/6 Meeting.

Closing of the Meeting

7.1 Dr. Somchanok, Chairperson of AP-ADO/TF thanked all participants and members of the Task Force attending the AP-ADO/TF/5 Meeting and for their valuable contribution and cooperation to the Meeting.

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Aerodromes to be listed in Asia Pacific Air Navigation Plan [Updated on 21 June 2023]

Sub-region	State / Admin	ICAO Code	Name of City	Name of Aerodrome	Type	Listed in APAC ANP
SA	Afghanistan	OAHR	Herat	Herat Intl	UNK	0
SA	Afghanistan	OAMS	Mazar-e-Sharif	Mazar-e-Sharif	UNK	0
SEA	Cambodia	VDSV	Sihanouk	Sihanouk Intl	UNK	0
NA	China	ZBOW	Baotou		UNK	0
NA	China	ZGBH	Beihai		UNK	0
NA	China	ZBAD	Beijing	Daxing	UNK	0
NA	China	ZYCC	Changchun	Longjia	UNK	0
NA	China	ZSCG	Changzhou	Benniu	UNK	0
NA	China	ZLDH	Dunhuang		UNK	0
NA	China	ZHES	Enshi	Xujiaping	UNK	0
NA	China	ZSGZ	Ganzhou	Huangjin	UNK	0
NA	China	ZUGY	Guiyang	Longdongbao	UNK	0
NA	China	ZBLA	Hulunbeier	Hailar	UNK	0
NA	China	ZJHK	Haikou	Meilan	UNK	0
NA	China	ZWTN	Hotan		UNK	0
NA	China	ZSSH	Huai'an	Lianshui	UNK	0
NA	China	RCYU	Hualien	Hualien	UNK	0
NA	China	ZSTX	Huangshan	Tunxi	UNK	0
NA	China	ZYJM	Jiamusi		UNK	0
NA	China	ZGOW	Jieyang	Chaoshan	UNK	0
NA	China	ZULS	Lhasa	Gonggar	UNK	0
NA	China	ZSLG	Lianyungang	Baitabu	UNK	0
NA	China	ZPLJ	Lijiang	Sanyi	UNK	0
NA	China	ZSLY	Linyi	Shubuling	UNK	0
NA	China	ZHLY	Luoyang	Beijiao	UNK	0
NA	China	ZPMS	Dehong	Mangshi	UNK	0
NA	China	ZBMZ	Manzhouli	Xijiao	UNK	0
NA	China	ZYMD	Mudanjiang	Hailang	UNK	0
NA	China	ZSCN	Nanchang	Changbei	UNK	0
NA	China	ZSNT	Nantong	Xingdong	UNK	0
NA	China	ZSNB	Ningbo	Lishe	UNK	0
NA	China	ZBDS	Ordos	Ejin Horo	UNK	0
NA	China	ZYQQ	Qiqihar	Sanjiazi	UNK	0
NA	China	ZSQZ	Quanzhou	Jinjiang	UNK	0
NA	China	ZBSJ	Shijiazhuang	Zhengding	UNK	0
NA	China	RCMQ	Taichung	Cingcyuangang	UNK	0
NA	China	RCNN	Tainan	Tainan	UNK	0
NA	China	ZSWH	Weihai	Dashuipo	UNK	0
NA	China	ZSWZ	Wenzhou	Longwan	UNK	0
NA	China	ZSWX	Wuxi	Shuofang	UNK	0
NA	China	ZSWY	Wuyishan		UNK	0

Sub-region	State / Admin	ICAO Code	Name of City	Name of Aerodrome	Type	Listed in APAC ANP
NA	China	ZLXN	Xining	Caojiabao	UNK	0
NA	China	ZPJH	Xishuangbanna	Gasa	UNK	0
NA	China	ZSXZ	Xuzhou	Guanyin	UNK	0
NA	China	ZSYN	Yancheng	Nanyang	UNK	0
NA	China	ZYYJ	Yanji	Chaoyangchuan	UNK	0
NA	China	ZSYT	Yantai	Penglai	UNK	0
NA	China	ZSYA	Yangzhou	Taizhou	UNK	0
NA	China	ZHYC	Yichang	Sanxia	UNK	0
NA	China	ZLIC	Yinchuan	Hedong	UNK	0
NA	China	ZSYW	Yiwu		UNK	0
NA	China	ZGZJ	Zhanjiang		UNK	0
NA	China	ZGDY	Zhangjiajie	Hehua	UNK	0
NA	China	ZHCC	Zhengzhou	Xinzheng	UNK	0
NA	China	ZSZS	Zhoushan	Putuoshan	UNK	0
NA	China	ZUZY	Zunyi	Xinzhou	UNK	0
PAC	Cook Islands	NCAI	Aitutaki		UNK	0
SA	India	VEBS	Bhubaneswar		UNK	0
SA	India	VICG	Chandigarh		UNK	0
SA	India	VOGO	Goa		UNK	0
SA	India	VOPB	Port Blair		UNK	0
SA	India	VAPO	Pune		UNK	0
SA	India	VISR	Srinagar		UNK	0
NA	Japan	RJAH	Hyakuri		UNK	0
NA	Japan	RJNK	Komatsu		UNK	0
NA	Japan	RJCO	Sapporo	Sapporo	MIL	0
NA	Japan	RJOS	Tokushima		UNK	0
NA	Japan	RJOH	Yonago	Miho	UNK	0
PAC	Micronesia	PTSA	Kosrae I.	Kosrae	UNK	0
NA	Mongolia	ZMCD	Dornod	Choibalsan	UNK	0
PAC	N. Mariana Is.	PGWT	Tinian I.	West Tinian	UNK	0
PAC	Solomon Islands	AGGM	Munda		UNK	0
SA	Sri Lanka	VCCJ	Jaffna		UNK	0
SEA	Viet Nam	VVDL	Da Lat	Lien Khuong	UNK	0

Notes: -

Australia: Need to finalize the Table AOP II -1, APAC ANP V-II.

US

1) Tinian I./West Tinian [PGWT] for N. Mariana Is. should be added in Table AOP I – 1 of APAC ANP V - I and Table AOP II – 1 of APAC ANP V - II.

2) JOHNSTON ATOLL/Johnston I (PJON) should be withdrawn from Table AOP I – 1 of APAC ANP V - I and Table AOP II – 1 of APAC ANP V - II as it had been permanently closed

AP-ADO/TF/5 – **WP/06**
Agenda Item 4

International Civil Aviation Organization

The Fifth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/5)

Chiang Rai, Thailand, 30 January – 2 February 2024

Agenda Item 4: Planning, Design and Construction of Aerodromes

INCONSISTENCY REQUIREMENT IN ICAO ANNEX 14 VOLUME I

(Presented by Malaysia)

SUMMARY

This paper presents the inconsistency observed of requirements in ICAO Annex 14 Volume I and also collates additional information from other guidance material (ICAO Aerodrome Design Manual Part 4, ACI Handbook and FAA's safety study) and present to the meeting for discussion. This paper makes recommendations on such adoptions for the meeting's consideration.

1. INTRODUCTION

1.1. AOP-SG/7 held in June 2023 discussed the AP-ADO/TF/4 outcomes with the issues of inconsistency in ICAO Annex 14 Standards and Recommended Practice and invited members to highlight in the next AP-ADO/TF/5. Draft Conclusion AOP-SG/7-1 referred.

1.2 This paper further deliberates the issue and makes recommendations for the meeting's consideration on the inconsistency of requirements in Annex 14 Volume I with the objectives of reaching a draft conclusion to ensure uniformity in implementing SARPs and to enhance aerodrome safety and efficiency.

2. DISCUSSION

Current Requirements in Annex 14 Volume I

2.1 The inconsistency identified in Annex 14 Volume I will confuse the State in adopting the SARPs related to some requirements in Taxiway Centerline Marking, Threshold Marking, Taxiway Transverse Stripe, Pavement Edge Flushing, and Precision Approach Lighting

2.2 The following are the inconsistency identified which required deliberation:

Taxiway Centerline Marking

2.3 Annex 14 Vol 1 Clause 5.2.8.1 identified taxiway centre line shall be continuous only at runway centre line and aircraft stands.

"5.2.8.1 Taxiway centre line marking shall be provided on a paved taxiway, de-icing/anti-icing facility and apron where the code number is 3 or 4 in such a way as to provide continuous guidance between the runway centre line and aircraft stands."

Clarification is required on whether taxiway centre line markings should be interrupted or continuity is required when crossing the other three (3) runway markings i.e. aiming point marking, touchdown zone marking, and threshold marking (for taxiway centre line and turn pad marking).

Threshold Marking

2.4 There is inconsistency of Annex 14 Volume I Clause 5.2.4.4 which stated requirement of threshold marking shall commence 6 m from the threshold in comparison to Figure 5-2, indicates that the distance shall commence at a minimum of 6 m.

"5.2.4.4 The stripes of the threshold marking shall commence 6 m from the threshold."

Clarification is required to ascertain whether the requirement is minimum of 6 m or must be exactly 6 m.

Taxiway Transverse Stripe

2.5 ICAO ADM Part 4, Clause 2.2.3, stated *"transverse stripe width shall be 0.9 m and they should extend to within 1.5m of the outside edge of the stabilized paving or be 7.5 m long, whichever is shorter."*

Clarification is required because as a matter of best practices by some airports, it is recommended to adopt ACI Handbook which implies a maximum distance of 1.5 m for transverse stripes on low-strength shoulders.

Flush of Pavement Edge with strip

2.6 Annex 14 Volume I 3.4.10 specifies flush surfaces between portions of a strip that abuts a runway, shoulder or stopway which is impractical to achieve.

"3.4.10 The surface of that portion of a strip that abuts a runway, shoulder or stopway shall be flush with the surface of the runway, shoulder or stopway."

Clarification is required on the absence of flush tolerance as a safety study by FAA indicated tolerance of 3 inches is acceptable and adopted the requirement as *"The pavement edges must not exceed 3 inches difference in elevation between abutting pavement sections and between pavement and abutting areas".*

Precision of Approach Light

2.7 Annex 14 Volume I Clause 5.3.4.12 requires precision approach light Cat 1 and II with longitudinal intervals of 30 m, however the Figure A - 8 indicates that the installation tolerances.

"5.3.4.12 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold."

The inconsistency between the text and the figure could lead to misinterpretations in aerodrome design and operations which require clarification.

Recommendation on the Inconsistency to ICAO SARPs

Refer to Attachment - slide presentation for details.

2.8 Item in paragraphs 2.3 and 2.5 require further deliberation and safety assessment.

2.9 It is recommended the establishment of such tolerance for item in paragraphs 2.4, 2.6 and 2.7.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) deliberate on the information contained in this paper;

b) consider and adopt the recommendations described in paragraphs 2.8 and 2.9 above; and

c) discuss any relevant matters as appropriate.

— — — — — — —

<table>
<tr><td colspan="3">Draft Conclusion/Decision AP-ADO/TF/5 – X: INCONSISTENCY REQUIREMENT IN ICAO ANNEX 14 VOLUME I</td></tr>
<tr><td colspan="2">What: The inconsistency will cause difficulty for States to establish standard and recommended practices (SARPs) since there are conflicting requirement in Annex 14 Volume I</td><td>Expected impact:
☒ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: Resolving the issues of inconsistency will enable States to establish clear standard and recommended practices (SARPs) without neglecting the safety and efficiency</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 2-Feb-24</td><td colspan="2">Status: Adopted by PIRG</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

—END—


CAAM
Fifth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force
Conflicting Clause in ICAO Annex 14, Vol 1, Aerodrome Design and Operations.
A joint collaborative study with Malaysia Airports Holdings Berhad (MAHB)
Chiang Rai, Thailand
30th January - 2nd February 2024
CIVIL AVIATION AUTHORITY OF MALAYSIA
1


Objective of The Session
CAAM
To **seek clarification** and **recommendation** from ICAO on the following items:-
1 A Proposal for Amendments to Taxiway Centre Line Marking Standards in Aerodrome Design and Operations
2 Threshold Marking: Clarification on Commencement Distance
3 ICAO ADM Part 4 - Clarification on Transverse Stripe Placement
4 Paved Area Tolerance in ICAO Annex 14 Vol. I
5 Precision Approach Lighting System on Longitudinal Intervals
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2 Threshold Marking: Clarification on Commencement Distance

CAAM

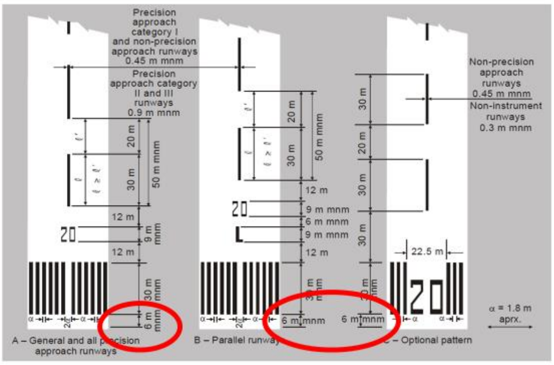


Figure 5-2. Runway designation, centre line and threshold markings

ICAO Annex 14, Volume I, Aerodrome Design and Operations

Para 5.2.4.4	Figure 5-2	Remark
The stripes of the threshold marking shall **commence 6m from the threshold**.	Indicates that the distance shall **commence at a minimum of 6 m**, not as a fixed value.	Clarification needed on the accurate interpretation of the commencement distance for threshold markings.

Clarifying whether the distance is a fixed **6m** or **a minimum value** will enhance precision and ensure uniform implementation of threshold markings across aerodromes.

3 Threshold Marking: Clarification on Commencement Distance

CAAM

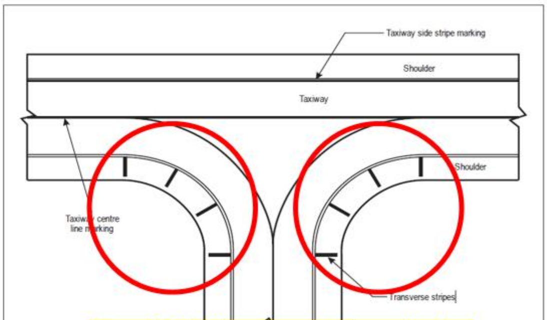
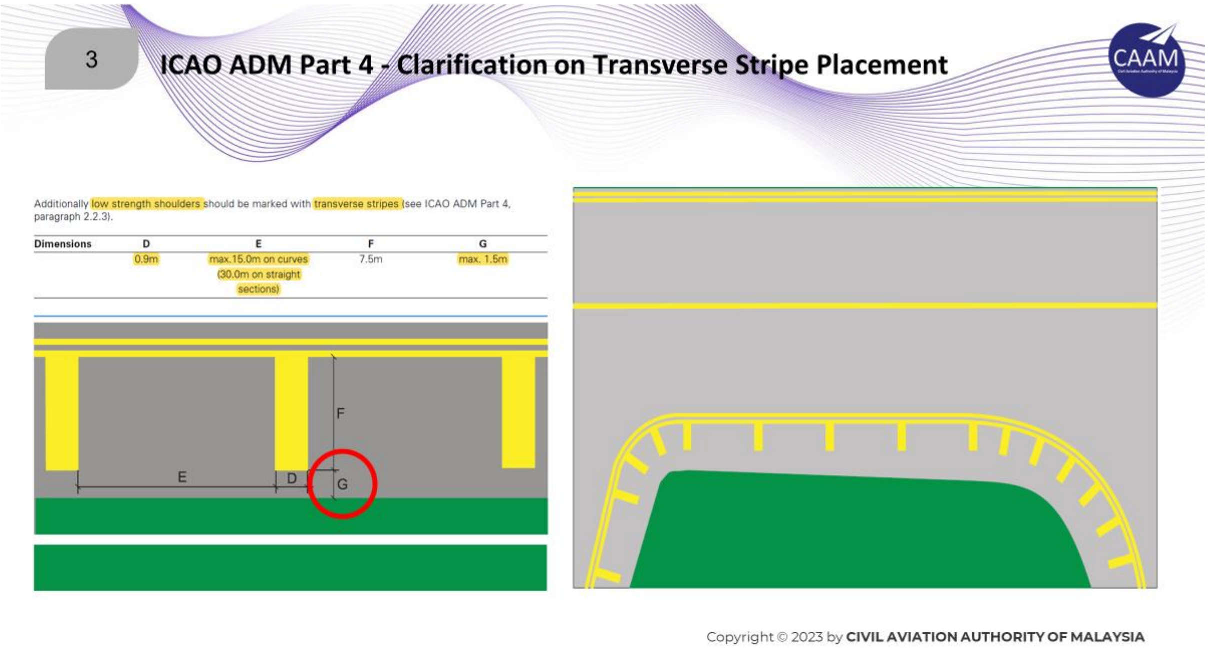


Figure 2-1. Marking of paved taxiway shoulders

ICAO ADM Part 4 Clause 2.2 Additional Marking of Paved Shoulders	ACI Apron Markings & Signs Handbook, 3rd Edition 2017 Clause 2.3	Remark
The width of the marks should be 0.9 m, and they should extend to **within 1.5 m** of the outside edge of the stabilized paving or be **7.5 m long**, whichever is shorter.	A maximum distance of **1.5m** for transverse stripes on low-strength shoulders.	Seeking clarification to harmonize these guidelines and establish a consistent standard for transverse stripe placement on paved shoulders.


3
ICAO ADM Part 4 - Clarification on Transverse Stripe Placement
CAAM
Additionally low strength shoulders should be marked with transverse stripes (see ICAO ADM Part 4, paragraph 2.2.3).
Dimensions D E F G
0.9m max.15.0m on curves (30.0m on straight sections) 7.5m max. 1.5m
F
E
D
G
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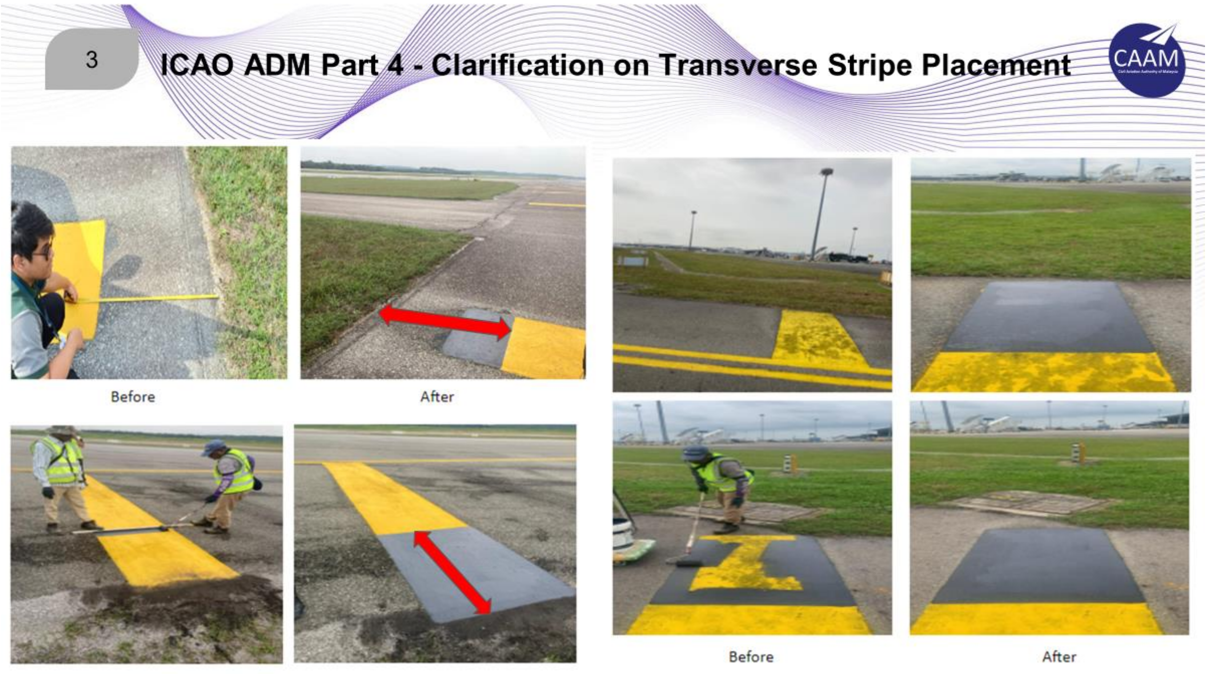
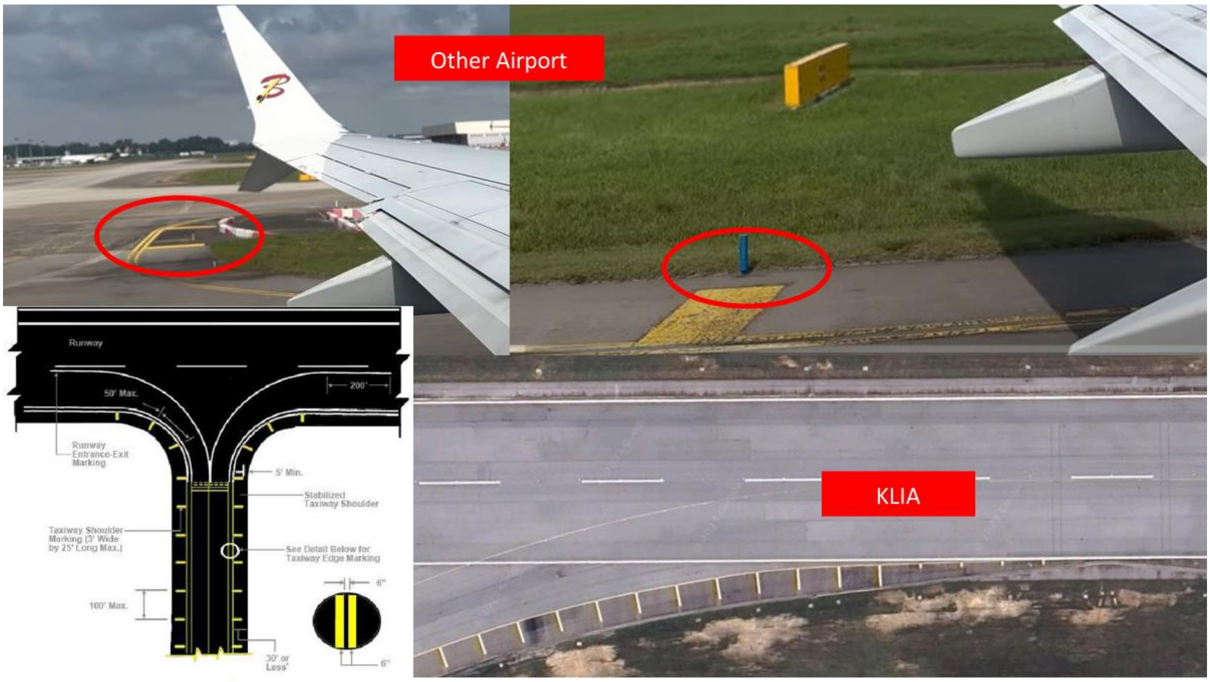
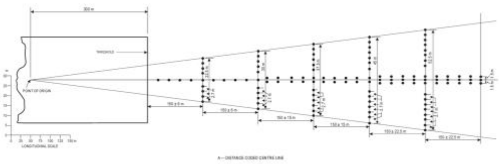

3
ICAO ADM Part 4 - Clarification on Transverse Stripe Placement
CAAM
Before
After
Before
After

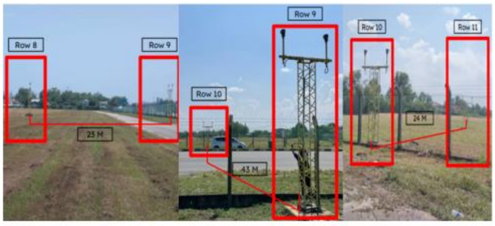


4 Paved Area Tolerance in ICAO Annex 14 Vol. I

FAA Part 139, Section 305 for Paved Areas	ICAO Annex 14, Vol. I, Grading of Runway Strips Para 3.4.10	Remark
The pavement edges **must not exceed 3 inches** difference in elevation between abutting pavement sections and between pavement and abutting areas.	3.4.10 The surface of that portion of a strip that abuts a runway, shoulder or stopway **shall be flush** with the surface of the runway, shoulder or stopway	Propose ICAO clarifies and incorporates a minimum allowable tolerance for paved and unpaved areas in Annex 14 Vol. I. to provide clear guidance to member states and give harmonized approach to aerodrome design.

5 Precision Approach Lighting System on Longitudinal Intervals



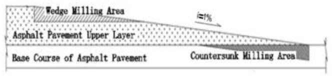


ICAO Annex 14, Volume I, Aerodrome Design and Operations Para 5.3.4.12 & 5.3.4.23	ICAO Annex 14, Volume I, Aerodrome Design and Operations Figure A - 8	Remark
Precision Approach CAT I Lighting System 5.3.4.12 longitudinal intervals of 30 m with the innermost light located 30 m from the threshold. **Precision Approach CAT II & III Lighting System** 5.3.4.23 Longitudinal intervals of 30 m with the innermost lights located 30 m from the threshold.	Indicates that the installation tolerances.	This inconsistency between the text and the figure could lead to misinterpretations in aerodrome design and operations.

Conclusion

We seek clarification from the ICAO on the conflicting clause in ICAO Annex 14, Vol 1, Aerodrome Design and Operations on the above issues for continuous enhancement level of safety and efficiency of aerodrome operations

Questionnaire on Temporary Ramps of Overlay Project
[State/Administration Name:………]

Airport name /ICAO Code	Pavement structural	Overlay structural	Whether to adopt the non-suspending air service construction?	Temporary ramp structure	Temporary ramp slope	The number of temporary ramps	Implementation time of a single temporary ramp	Construction time without air service suspension	Temporary ramp utilization and corresponding safety risks	Remarks
Xiamen Gaoqi International Airport /ZSAM	PCC	6cm SMA-13 +8cm AC-20	YES		1%	28	30-45min	5h per night	Non	Single Runway
Please follow an above example to complete the questionnaire.										

Please Send the Completed Form before 30 April 2024.
If Any Question, Please Contact: apac@icao.int.

AP-ADO/TF/5 – **WP/08**
Agenda Item 4

International Civil Aviation Organization

The Fifth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/5)

Chiang Rai, Thailand, 30 January – 2 February 2024

Agenda Item 4: **Planning, Design and Construction of Aerodromes**

REVIEW ON THE COLOR SHIFT CHARACTERISTICS IN RELATION TO THE PHOTOMETRIC TESTING REQUIREMENTS PERTAINING TO THE AERONAUTICAL GROUND LIGHTING SYSTEMS USING SOLID STATE LIGHTING (LED'S)

(Presented by India)

SUMMARY

This paper presents the study on the importance of the colour aspects of the Aeronautical Ground Lighting system. With the evolution of LED technology several aspects of operational and maintenance have undergone a change. With the long-life span of the LED lighting the operational intervention reduced considerably. The chromaticity diagram for solid-state lighting with change in the boundaries in the colour has been introduced. The paper discusses the additional aspects of photometric testing which need to be taken care of and monitored to ensure compliance of the AGL system.

The paper is going to speak about the information on the importance of measuring the colour shift especially in the LED - AGL systems, the probable reasons for the colour shift, the regulatory standards on measuring the photometric performance of the different AGL systems and the proposal for further review.

1. INTRODUCTION

1.1 The four C's of the AGL system are colour, candela, coverage, and configuration. In the initial days the required colour for the specific AGL system is being achieved through the colour filters. With the technological evolution of LED's, the colour is being produced by compound semiconductor materials such as gallium arsenide, gallium phosphide and indium phosphide and junctions made from these materials are used to emit light. These compounds are selected and used to produce the required chosen colours. When the colour filters are utilized along with the usage of halogen lamps, although the colour filters are mostly reliable the colour stability is affected due to the degradation of the lamp performance over time. Also, when halogen lamps are used, the variable white issues exist i.e., at lower intensities especially with the runway lights, the white lights are perceived to be drifted into the yellow zone. Based on these properties, the white colour boundaries for halogens are determined accordingly (refer Fig A1-1a -ICAO Annex 14 SARPS). This happens because of the default correlated colour temperature of the halogen lamps.

The CCT or Correlated Color Temperature is a specification of the color appearance of the light emitted by a light source, relating its color to the color of light from a reference source when heated to a particular temperature, measured in degrees Kelvin (K).([Correlated Color Temperature (CCT) (nextgenerationled.be)](nextgenerationled.be)

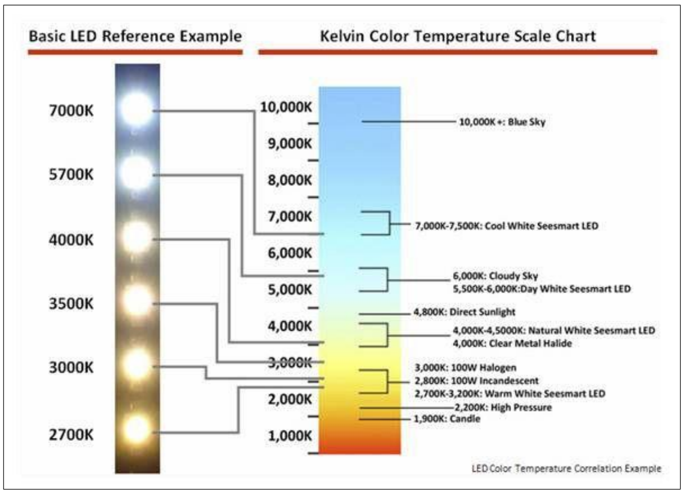


Fig 1: Colour temperature chart (387) Pinterest)

1.2 The above concern is resolved with the use of solid-state lighting. In the LED lighting, with the change in the intensities the colour parameter remains constant with better saturation. Due to longer life span of the LED's, which is about 50,000 hours, it takes at least ten years for the lumen depreciation to drop considerably subjected to the design, quality of the products, designed vs actual operating range of driving current and temperature. With LEDs when installed in the luminaire, the degradation / lumen depreciation is usually due to the high temperatures, voltage fluctuation, driver or electrical component issues and degradation of the semiconductor components. However, along with the lumen depreciation, the colour stability also could be affected in the LED lighting system due to operation at higher temperatures, higher driving currents with time and several other reasons which would be discussed in the below paragraphs. Also, the regulatory standards referred to colour form ICAO Annex 14 Vol 1 and ADM part-4 – Visual Aids would be discussed in the guidance provided.

Fig 2. Typical color shift symptoms observed in runway centreline lighting (source: Anonymous)

2. REGULATORY REFERENCES AND STANDARDS

2.1 As per ICAO Annex 14- SARPS

APPENDIX 1. COLOURS FOR AERONAUTICAL GROUND LIGHTS, MARKINGS, SIGNS AND PANELS

1. General

Introductory Note.— The following specifications define the chromaticity limits of colours to be used for aeronautical ground lights, markings, signs, and panels. The specifications are in accord with the 1983 specifications of the International Commission on Illumination (CIE), except for the colour orange in Figure A1-2.

It is not possible to establish specifications for colours such that there is no possibility of confusion. For reasonably certain recognition, it is important that the eye illumination be well above the threshold of perception, that the colour not be greatly modified by selective atmospheric attenuations and that the observer's colour vision be adequate. There is also a risk of confusion of colour at an extremely high level of eye illumination, such as may be obtained from a high-intensity source at very close range. Experience indicates that satisfactory recognition can be achieved if due attention is given to these factors.

*The Chromaticities are expressed in terms of the standard observer and coordinate system adopted by the International Commission on Illumination (CIE) at its Eighth Session at Cambridge, England, in 1931. **

The Chromaticities for solid state lighting (e.g., LED) are based upon the boundaries given in the standard S004/E-2001 of the International Commission on Illumination (CIE), except for the blue boundary of white.

Note.— Guidance on chromaticity changes resulting from the effect of temperature on filtering elements is given in the Aerodrome Design Manual *(Doc 9157), Part 4.*

2.4 Colour measurement for filament-type and solid state-type light sources

2.4.1 The colour of aeronautical ground lights shall be verified as being within the boundaries specified in Figure A1-1a or A1-1b, as appropriate, by measurement at five points within the area limited by the innermost isocandela curve (isocandela diagrams in Appendix 2 refer), with operation at rated current or voltage. In the case of elliptical or circular isocandela curves, the colour measurements shall be taken at the centre and at the horizontal and vertical limits. In the case of rectangular isocandela curves, the colour measurements shall be taken at the centre and the limits of the diagonals (corners). In addition, the colour of the light shall be checked at the outermost isocandela curve to ensure that there is no colour shift that might cause signal confusion to the pilot.

Note 1.— For the outermost isocandela curve, a measurement of colour coordinates should be made and recorded for review and judgement of acceptability by the State.

Note 2.— Certain light units may have application so that they may be viewed and used by pilots from directions beyond that of the outermost isocandela curve (e.g. stop bar lights at significantly wide runway-holding positions). In such instances, the State should assess the actual application and if necessary, require a check of colour shift at angular ranges beyond the outermost curve.

10.5.3 **Recommendation.—** *The system of preventive maintenance employed for a precision approach runway category II or III should include at least the following checks:*

a) visual inspection and in-field measurement of ***<u>the intensity, beam spread and orientation of lights</u>*** *included in the approach and runway lighting systems;*

b) control and measurement of the electrical characteristics of each circuitry included in the approach and runway lighting systems; and

c) control of the correct functioning of light intensity settings used by air traffic control.

10.5.4 **Recommendation.—** *In-field measurement of* ***intensity, beam spread and orientation of lights*** *included in approach and runway lighting systems for a precision approach runway category II or III should be undertaken by measuring all lights, as far as practicable, to ensure conformance with the applicable specification of Appendix 2.*

10.5.5 **Recommendation.—** *Measurement of* ***intensity, beam spread and orientation of lights*** *included in approach and runway lighting systems for a precision approach runway category II or III should be undertaken using a mobile measuring unit of sufficient accuracy to analyse the characteristics of the individual lights.*

10.5.6 **Recommendation.—** *The frequency of measurement of lights for a precision approach runway category II or III should be based on traffic density, the local pollution level, the reliability of the installed lighting equipment and the* ***continuous assessment of the results of the in-field measurement.***

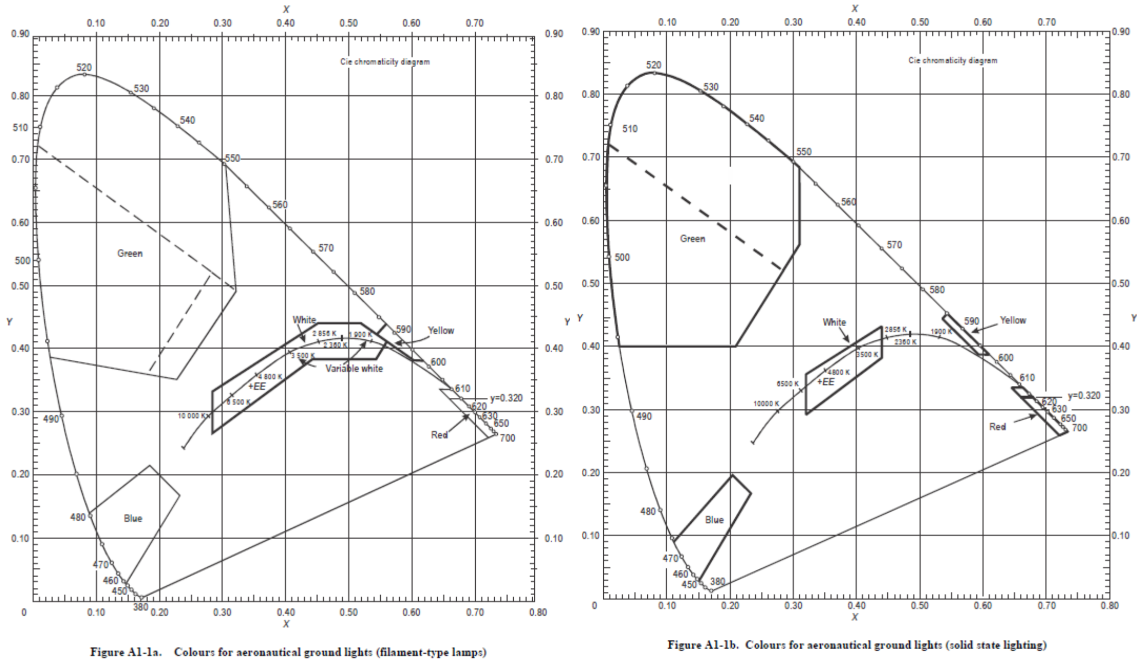


Figure A1-1a. Colours for aeronautical ground lights (filament-type lamps)

Figure A1-1b. Colours for aeronautical ground lights (solid state lighting)

Fig 3. Colors for Aeronautical ground lighting systems for Halogen and LEDs

2.2 From ADM Part 4- Visual Aids:

18.4.1 Whilst the functionality of the electrical supply and control elements of a lighting system is an important maintenance issue, it is the availability of the specified beam correctly aimed and emitting the correct colour that is often difficult to achieve. These parameters are the most common cause of substandard lighting performance. When a lighting system is installed, it should be capable of emitting intensity values shown in Annex 14, Volume I, Appendix 2, Figures A2-1 to A2-21. The maintenance objective must be to sustain the overall performance at these levels. However, it is not practicable to maintain the specified intensities at all times for every light in the system.

18.4.5 **The test equipment should measure and record the Isocandela diagram, alignment and color of each light, the tests being made with the lighting operating at the 100 per cent power supply level**.

Colour measurement

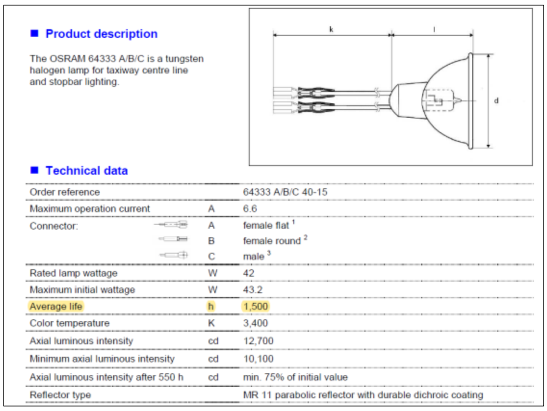
19.2.8 The colour emitted by the light unit should be verified in accordance with Annex 14, Volume I, Appendix 1, 2.4.1, when operating at rated current or voltage. It should be within the chromaticity boundaries of Annex 14, Appendix 1, FigureA1-1a or A1-1b, for the horizontal and vertical limits of the main beam (in the case of elliptical or circular Isocandela curves) or the limits of the diagonals of the main beam (in the case of rectangular Isocandela curves). Furthermore, the colour should be checked by measurement at similar limits for the outermost Isocandela curve. This latter check is to ensure that there is no unacceptable colour shift (e.g. red to yellow) at large angles of observation. Such colour shift can occur with some types of filter material depending upon the design details of the light unit. If the colour shift is outside the chromaticity boundary for that colour, the appropriate regulatory authority should be consulted for judgement of the acceptability of the amount of colour shift.

Note.— The above-mentioned check of colour coordinates may be extended at the request of the appropriate authority to cover angles outside the outermost Isocandela curve. This may be an important precaution for light units that have applicability where the angle of observation by the pilot can be outside the angles specified in the Isocandela diagram (e.g., stop bars at wide runway entrances).

3. PROPOSAL AND DISCUSSIONS

3.1 Why the measurement of colour shift in LEDs is more important when compared with Halogen?

3.1.1 The common aspects for the halogen and LED are the maintenance regime and optical components integrity which need to be taken care in all aspects as explained earlier, in halogen fixtures the colour shift mainly happens due to the lamp degradation. The average life of the halogen is about 3000-4000 hrs. (This has been mentioned, by considering that the lamp is being operated in all the 5 steps based on operational requirement. While @6.6A, generally the operating hours are about 1500 hrs.) i.e., less than 9-10 months when the lights are operated on an average of 14 hrs. per day. During the photometric tests, as per the regulatory requirements when considered to be done at least twice a year, the reason for deterioration in the colour (if any) or the photometric output mainly would be due to the lamp deterioration due to the lesser life span.



Product description

The OSRAM 64333 A/B/C is a tungsten halogen lamp for taxiway centre line and stopbar lighting.

Technical data

Order reference		64333 A/B/C 40-15
Maximum operation current	A	6.6
Connector:	A	female flat [1]
	B	female round [2]
	C	male [3]
Rated lamp wattage	W	42
Maximum initial wattage	W	43.2
Average life	h	1,500
Color temperature	K	3,400
Axial luminous intensity	cd	12,700
Minimum axial luminous intensity	cd	10,100
Axial luminous intensity after 550 h	cd	min. 75% of initial value
Reflector type		MR 11 parabolic reflector with durable dichroic coating

Fig 4. Typical average life of halogen lamp

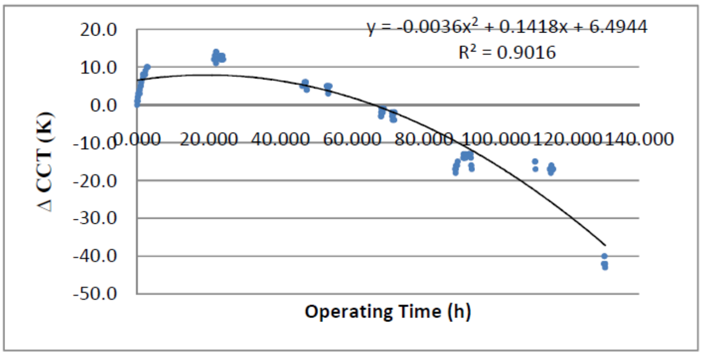


Fig 5. Change in CCT for an operating time upto 130 hrs. for a halogen lamp form the paper on *" Capability of testing the ageing behaviour of incandescent."*

From "LED luminaire reliability: Impact of color shift - Next Generation Lighting Industry Alliance, LED Systems Reliability Consortium"- *Traditional lighting technology, such as halogen, fluorescent, or metal halide technology, experiences color shifts. Frequent relamping every few years is required due to catastrophic failures or lumen depreciation, and this mitigates the impact of the color shift of these lighting technologies*.

For LEDs, the concept would change a little bit as the life is claimed to be about 50,000 hrs. i.e., more than 10 years. Hence, the installation (fixture) is used in operations for a period of about 8-10 years without replacing the LED (Luminaire) or any other optical components. So, when the system is in service for years together, the properties of the semiconductor components would vary resulting in gradual deterioration of the quality of the light output and possible colour shifts. Although the color stability is ensured in the initial years, there is need to evaluate the color shift aspects during its operational period.

From research paper, *Advanced Materials and Materials Genome—Review - Progress in Understanding Color Maintenance in Solid-State Lighting Systems,* *"Phosphor materials (used in all white LEDs) can degrade over time, leading to color shift. In some cases, it is not the phosphor material, but the position of the phosphor with respect to the LED that changes over time, allowing more or less blue light to be emitted. Deterioration of the binder material, which binds the phosphor to the LED die, may cause phosphor particles to detach, leading to an increase of scattering and an associated color shift."*

3.1.2 Also, in general the performance of the LEDs is analyzed for a period of 6000 hours only, after which the colour shift changes are not predicted. While, when the fixture is in actual operation, in addition to the above said challenges, this is also impacted by other stresses such as environmental and higher temperatures. At higher temperatures the colour shift happens at a faster rate as shown in Fig 9. Considering all these factors, the need to measure the photometric performances and colour shift at regular intervals is very much necessary.

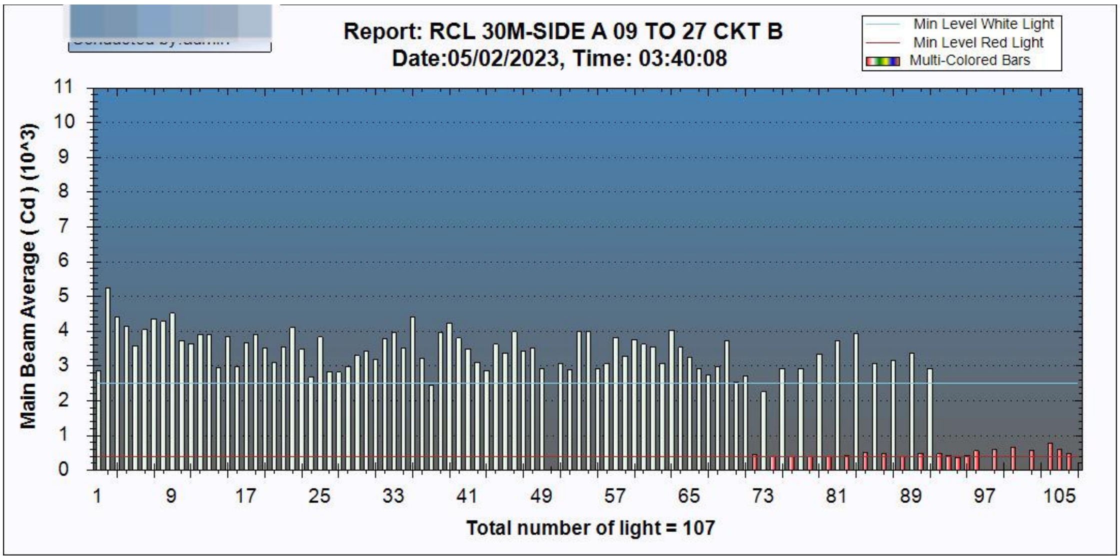


Fig 6. Bar chart of the photometric performance of the halogen fixtures of RCL

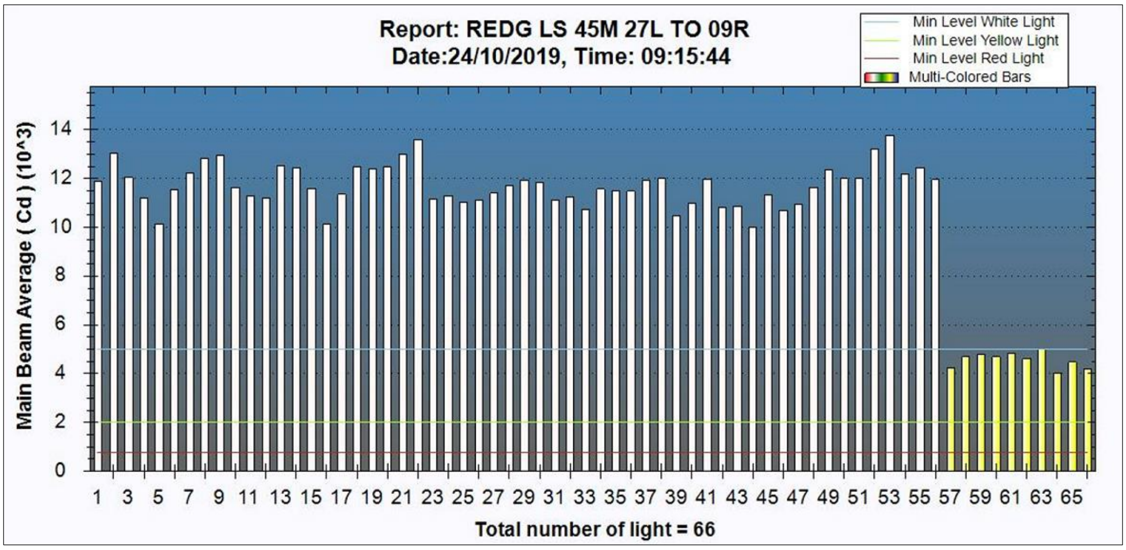


Fig 7. Bar chart of the photometric performance of the LED fixtures of runway edge

3.1.3 When we analyze the bar charts above, we see that in the halogen (Fig 6.), when the serviceability levels are more than 95% and each light fixture intensity levels are meeting the intensity requirement. As the intensity is to the requirement and the colour filters are more consistent in delivering the required colours, the colour shift issues usually wouldn't occur. While, with the LED the same is not always true. In the second bar chart (Fig 7.), the LED runway edge photometric intensities are complaint and serviceability levels are more than 95%.

While the photometric performances are still good, there is still a need to measure the colour shift. Because there is always a chance that the intensity is good and due to change in the properties of the semiconductors and other reasons that too after certain years, there are all chances of color shifts.

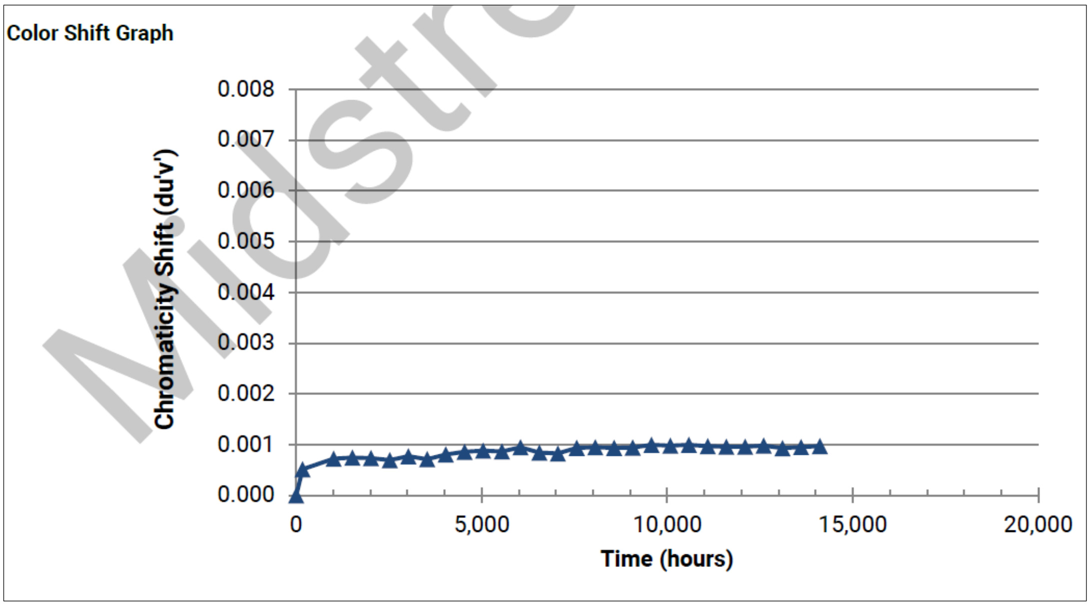


Fig 8. Typical colour shift graph from the LM 80 report.

We can see from the LM 80 report a typical graph of the color shift, where there is a very minor shift in the ideal conditions, while the conditions in the airfield scenario changes abruptly. The working temperatures, the operating currents etc., could vary, impacting the color shift. Also, we can notice that the prediction cannot be provided for the entire operating life of the LED's.

In addition to this, the below graph represents that the color shift would be impacted greatly due to the changes in the operating temperatures.

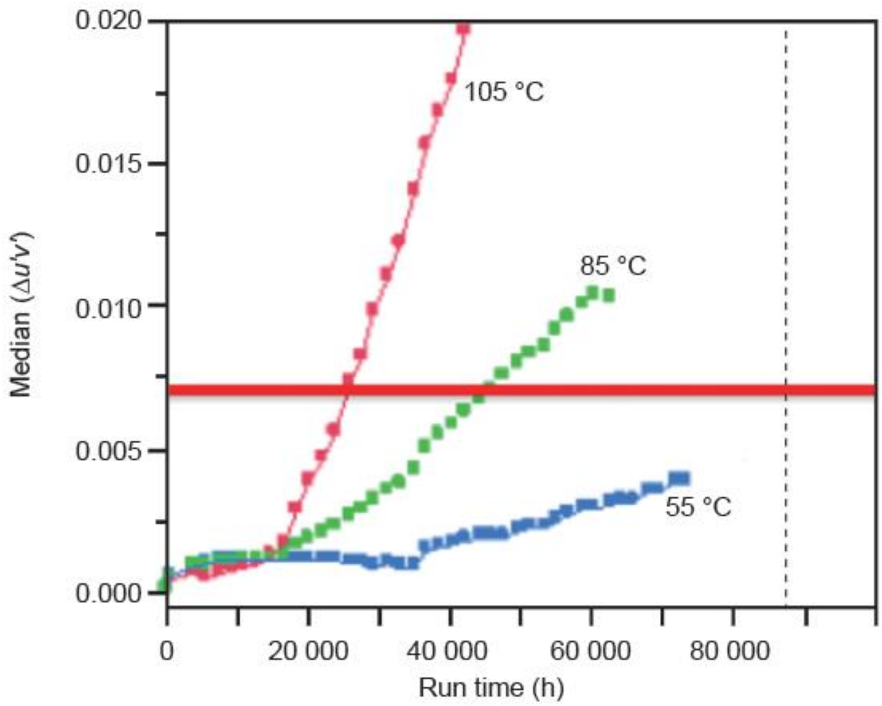


Fig 9. Impact of the colour shift with temperatures (Advanced Materials and Materials Genome—Review - Progress in Understanding Color Maintenance in Solid-State Lighting Systems)

3.2 Why does the colour shift happens in LED?

3.2.1 The quality, the colour temperature of the LEDs, the colour rendering index and the colour defines how the light is seen or perceived by an observer. However, light which is seen by the observer gradually deteriorates with time, although here in the case of solid-state lighting this may take years. Several tests and reports are required to state that the product developed meets the desired requirements of the lumen output, efficacy, and the performance for the designed period. The reports such as L70, LM 79, LM 80, and TM 21 etc., are needed to state that after installation of the LEDs in the designed fixtures, the overall properties are meeting to the requirements and the lifetime meeting the lumen output is assessed properly.

L70 is a lifetime measurement criterion developed by IESNA (Illuminating Engineering Society of North America) to evaluate the useful lifetime of an LED luminaire in terms of the expected number of operating hours until the light output has diminished to 70% of initial levels.

LM-79 is an approved process that measures the electrical and photometric properties of LED products. This process includes luminous flux, electrical power, efficiency, chromaticity as well as the diffusion of luminous intensity.

LM-80 is an approved process that measures the lumen maintenance of the flux for a group of electroluminescent diodes (LED) at various operating temperatures. LM-80 data usually includes colour measurement. Hence, any reputed make LED's usually will have colour maintenance data available for at least 6000 h.

TM-21 provides guidelines on the use of data compiled through LM-80 tests to assess the lifespan of a light source beyond the number of test hours recommended by LM-80

Both LM-80 and TM-21 results have been designed to be assessed together, as TM-21 uses test data provided by LM-80 with data obtained further to operating temperature.

Data Set	Case Temp. [TS]	Ambient Temp. [TA]	Drive Current [IF]	Average Lumen Maintenance at 6,000 Hours	(Average Chromaticity Shift (Δu'v') at 6,000 Hours	Reported TM-21 Lifetimes
1	85 °C	85 °C	3000 mA (6 V) 2000 mA (9 V) 500 mA (36 V)	94.5%	0.0020	L70(6k) > 36,300 hrs
1+	85 °C	85 °C	3000 mA (6 V) 2000 mA (9 V) 500 mA (36 V)	94.3%	0.0020	L90(13k) = 22,300 hrs L80(13k) = 59,200 hrs L70(13k) > 72,100 hrs
2	105 °C	105 °C	3000 mA (6 V) 2000 mA (9 V) 500 mA (36 V)	90.2%	0.0034	L70(6k) = 26,000 hrs
2+	105 °C	105 °C	3000 mA (6 V) 2000 mA (9 V) 500 mA (36 V)	90.2%	0.0034	L70(7k) = 27,700 hrs

Fig 10: Typical performance report in different conditions of a typical LED (LM 80 report for typical LED)

3.2.2 All these assessments mostly focus on the light output predominantly and its deterioration with time. While the aspects of colour shift analysis cannot be determined. This poses a great risk unlike other sources of luminaires such as halogens as the colour shifts occur only after several years of operation in LEDs and usually the trend may go unnoticed. Colour shift is the change in the colour from the initial day when it is in operation with the time based on several factors such as quality of LEDs chosen, the methodology chosen to dissipate the heat or reduce the junction temperature inside the fixture, its driving current under different circumstances and climatic conditions, the aging effect etc., all could contribute to the colour shift. Hence, colour stability is an important factor which need to be considered by the manufacturers in ensuring the fixture with better longevity and performance are used at Airports.

3.2.3 The colour stability is the ability of the light source to maintain its colour over time. This can be deteriorated due to several reason such as degradation of the encapsulation, degradation of the semiconductor components, higher driving current leading to increase the junction temperatures etc.,

3.3 Measurement of Colour using Chromaticity Coordinates x, y:

3.3.1 In colorimetry, the quantification of colour is based on the three-component theory of colour vision, which states that the human eye possesses receptors for three primary colour (red, green, and blue) and that all colour is seen as mixtures of these primaries. In colorimetry, these components are referred to as X-Y-Z coordinates. These are called tristimulus values, while visualizing the same is a tough task and hence, graphical models and graphing methods are developed to visualize the colours easily. The x-y coordinate system is generally used.

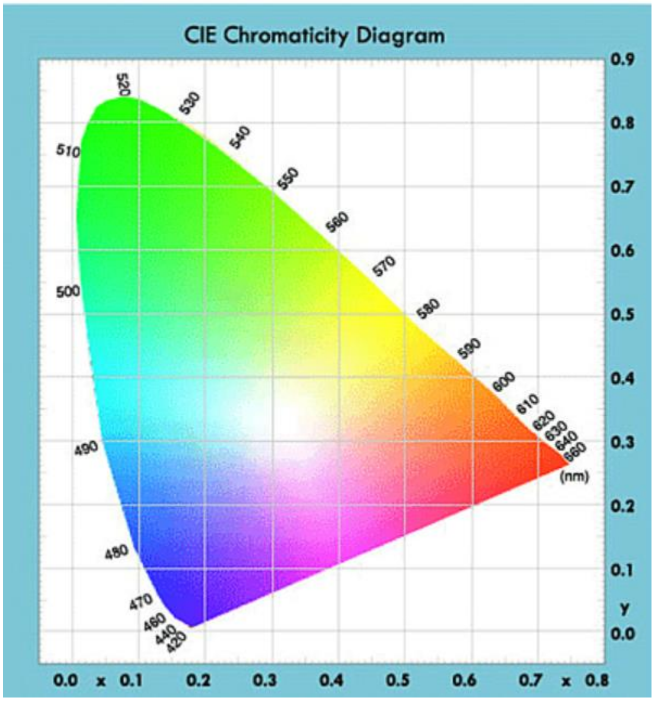


Fig 11 : CIE Chromaticity diagram

3.4 Standards of measurement as per the SARPs and the features of the present equipment

3.4.1 ICAO Annex 14 SARPs, Appendix 1- clause 2.4 provides the guidance on measuring the colour at centre , horizontal and vertical limits for elliptical or circular iso candela curves and for rectangular to measure at the centre and the limits of the diagonals. The light colour at the outermost candela curve to ensure there is no colour shift which could cause signal confusion to the pilot.

3.4.2 These values to be recorded for review and judgement of acceptability by the State. In some cases, the regulator recommends measuring the colour beyond the outermost boundary of the Isocandela curve.

3.4.3 There is a huge discrepancy in the reality considering the present process of measuring the colours by the agencies in the field of measuring the photometric tests. Airport operators are more focused on the intensity measurements and meeting the ICAO/ Maintenance criteria. The criterion of measuring the color to be documented or reviewed to identify the colour and its shift year on year. This helps the operator to understand the actual scenario of the fixtures. In general, the LED fixtures are warranted for 2 years normally and in special cases for 5 years, however, the performance is measured against the intensity only. Whenever there is a great change in the colour shifts, the deviation can be monitored visually only. While the minor color shifts and the trend they drift from one value to another value cannot be inspected visually.

3.4.4 Vendors/ Agencies delivering the services of photometric measurement of the AGL fixtures at airports, to further focus on these standards for reviewing the color measurement check as intended by the regulator. Along with the measurement of average intensities and ratios, the color parameter to be measured as part of understanding the color shift trend with time.

AGENCY A International Airport A

Report Name : RCL 15M CAT3-SIDE A - 27L T2 **Date:** 25-10-2021

Time: 08:37:22

Measurement run by: admin **Scanning Direction:** Forward

Number of lights : 267
Passed Light (%) : 100
Number of passed Lights: 267

Compliance of AGL Function: Compliant
Unserviceable lights tolerance (% 5
Faulty Light (%): 0
Number of faulty Lights: 0

Light No	Light Ref	Average (Cd)	Max Beam(Cd)	Max Beam (V°)	Max Beam (H°)	ICAO (%)	Status	x chrom	y chrom	Algt	Color	Xgps	Ygps
1	RCL-09R-	4757	6231	4.2	-0.4	95	PASS	0.369	0.365	G	W	1311.3648	7743.604561
2	RCL-27L-12	4915	6487	4.4	0.9	98	PASS	0.394	0.369	G	W	1311.364931	7743.59618
3	RCL-09R-	4009	4409	3.0	2.0	80	PASS	0.385	0.367	G	W	1311.365096	7743.588023
4	RCL-27L-12	4764	6288	4.2	-0.4	95	PASS	0.385	0.369	G	W	1311.365254	7743.579682

Fig 12. Typical photometry report mentioning the color and coordinates

3.4.5 Based on the above report, the X chromaticity value and Y chromaticity value are clearly depicted with the reference colour as “White”.

3.4.6 While the following questions are still to be answered when converted from Halogen to LED:

- Whether measuring color as a requirement is being followed at all the airports? If yes the color shift is measured year on year while using the LEDs?
- Whether the exact process as guided by the regulatory standards are followed?
- Whether the color in the outer most curve is being measured to assess the color shift ?

In reference to the same, it is being proposed to include the color aspect in the photometric measurement concept as part of preventive maintenance schedule deployment, which basically pushes the Agencies and the operators to focus on the colour aspect.

4. INFERENCES

4.1 Based on the above discussion, the following conclusions can be drawn:

i. Identifying the Colour shift in LEDs is more of a serious concern due to its long-life span.

ii. Several factors such as higher junction temperatures, higher driving currents and the degradation of the materials can result in early color shifts.

iii. The maintenance regime is common for both halogen and LED.

iv. In reality, color shifts can only be noticed after a certain period of use. In halogen lamps this happens mainly due to the degradation of the lamps and due to lesser life span, as the same would be replaced at regular intervals, the color shift issue would be handled eventually.

v. Although the lamp life is 50,000 hours, the test reports can ascertain the lamp life, color shift and lumen efficacy only upto period of 6000 hours only. Although with TM21 projections luminous efficiency can be projected for a certain period in different temperatures, the same is not possible to project the color shifts. Hence, a regular monitoring & testing mechanism shall be employed for ensuring the photometric output and properties of the LEDs are meeting the requirements.

vi. The color shift needs to be measured at centre and at the horizontal and vertical limits of the Isocandela diagram for the elliptical or circular beams. Along with these measurements, the colour at the outermost Isocandela curve beam to be measures and for some applications, the lights may be used beyond that of the outermost Isocandela curve (e.g., stop bar lights at significantly wide runway-holding positions) and in those cases, the State should assess the actual application and if necessary, require a check of colour shift at angular ranges beyond the outermost curve.

vii. The clause 18.4.5 from ADM part 4 also clearly states that **"The test equipment should measure and record the Isocandela diagram, alignment and color of each light, the tests being made with the lighting operating at the 100 per cent power supply level."** The required aspect of measuring the colour is clearly stated in ADM part 4 and reference on the guidance on measurement of color shift is referred to in the ICAO. However, inclusion of measuring color as part of recommended standards is proposed in this paper as part of ICAO requirements. The requirement of mentioning the monitoring of "color" parameter is needed to ensure the color shift is monitored very closely especially with the LED's. This makes the Airports, AGL manufacturers and photometric agencies to focus more seriously on measuring the color as one of the prime parameters along with intensity.

viii. More predictive methods to analyse the LEDs functionality with respect to performance and color properties to be evaluated for the operating period of the life by the manufacturers.

ix. AGL product manufacturers mainly assemble the subcomponents purchased from several other agencies. The LEDs are generally procured from the LED manufacturer and used by AGL manufacturer. In general, the AGL application is quite different unlike other domestic applications such as Building lighting, high mast lighting etc., as here physical load is exerted upon the fixture. The LED manufacturer and the AGL product manufacturer shall assess the LEDs based on these factors also and its impact on the performance of the AGL fixtures.

x. In order to emphasize the importance of color shift, at the least, the same need to be measured as a first point. Hence, along with the photometric parameters, it is being proposed to measure the color as a basic need.

5. ACTION BY THE MEETING

5.1 The meeting is invited to:

a) note the information contained in this paper; and

b) review, discuss and recommend the following revisions in “Annex 14, Volume I, 10.5 Visual aids”:

10.5.3 **Recommendation.—** *The system of preventive maintenance employed for a precision approach runway category II or III should include at least the following checks:*

a) visual inspection and in-field measurement of the intensity, beam spread, colour and orientation of lights included in the approach and runway lighting systems;

b) control and measurement of the electrical characteristics of each circuitry included in the approach and runway lighting systems; and

c) control of the correct functioning of light intensity settings used by air traffic control.

10.5.4 **Recommendation.—** *In-field measurement of intensity, beam spread, colour and orientation of lights included in approach and runway lighting systems for a precision approach runway category II or III should be undertaken by measuring all lights, as far as practicable, to ensure conformance with the applicable specification of Appendix 2.*

10.5.5 **Recommendation.—** *Measurement of intensity, beam spread, colour and orientation of lights included in approach and runway lighting systems for a precision approach runway category II or III should be undertaken using a mobile measuring unit of sufficient accuracy to analyse the characteristics of the individual lights.*

—END—

AP-ADO/TF/5 – **WP/09**
Revision 01
Agenda Item 4

International Civil Aviation Organization

The Fifth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/5)

Chiang Rai, Thailand, 30 January – 2 February 2024

Agenda Item 4: Planning, Design and Construction of Aerodromes

REVIEW ON THE REQUIREMENT OF THE RUNWAY GUARD LIGHTS PROVISION WHEN STOP BARS ARE AVAILABLE AND RECOMMENDATIONS ON THE STOP BAR OPERATION SEQUENCE TIMINGS

(Presented by India)

SUMMARY

This paper presents on the review on the requirement of the runway guard lights provision and the dependency of the stop bar lighting at Airports when operated under different operational conditions. As per the SARPs the runway guard lights are provided where stopbars are not installed or operated. The paper discusses on the proposed recommendations on the safety and operational aspects of the stop bar sequence of operations in conjunction with the provision of the runway guard lights.

1. INTRODUCTION

1.1. Stop bar lighting is an effective measure to prevent runway incursions along with the other visual aids especially during the low visibility operations. Some studies suggest that the stop bar lighting, when put into operation for 24 hrs., will be more effective. Interlocking provision to be made as per the standards for the TCLs and the STOP BARS for providing the visual conformation to the pilot on the clearance. While the ATC communication clearance is another mandate which shall be followed for crossing the runway holding position and entering the runway.

1.2. In line with the same, the regulations pertaining to ICAO- ANNEX 14 & ADM part - 4 provide guidance on the provision of stop bar lighting. Also, the other related clauses pertaining to the provision of the runway guard lighting system when stop bars are made available etc., are also discussed with the proposed changes.

2. REGULATORY REFERENCES AND STANDARDS:

2.1 As per ICAO Annex 14- SARPS

5.3.20.12 The lighting circuit shall be designed so that:

a) stop bars located across entrance taxiways are selectively switchable;

b) stop bars located across taxiways intended to be used only as exit taxiways are switchable selectively or in groups;

c) when a stop bar is illuminated, any taxiway centre line lights installed beyond the stop bar shall be extinguished for a distance of at least 90 m; and

d) stop bars are interlocked with the taxiway centre line lights so that when the centre line lights beyond the stop bar are illuminated the stop bar is extinguished and vice versa.

Note.— Care is required in the design of the electrical system to ensure that all of the lights of a stop bar will not fail at the same time. Guidance on this issue is given in the Aerodrome Design Manual *(Doc 9157), Part 5.*

5.3.23.1 Runway guard lights, Configuration A, shall be provided at each taxiway/runway intersection associated with a runway intended for use in:

a) runway visual range conditions less than a value of 550 m where a stop bar is not installed; and

b) runway visual range conditions of values between 550 m and 1 200 m where the traffic density is heavy.

2.2 From ADM Part 4 - Visual Aids:

10.4.14 The specifications for stop bars include a provision for the suppression of the taxiway centre line lights for a distance of 90 m beyond an activated stop bar in the direction that is intended for an aircraft to proceed. When the stop bar is suppressed these inter-linked taxiway centre line lights shall be simultaneously illuminated.

10.4.15 An aircraft that is stationary at a stop bar may require at least 30 seconds to move the 90 m covered by the interlocked taxiway centre line lights. Premature reselection of the stop bar after the issue of a clearance may, particularly in low visibility conditions, result in the pilot having less than the required segment of lighting guidance.

10.4.19 Annex 14, Volume I, specifies, as a Standard, that runway guard lights, Configuration A, shall be provided at each taxiway/runway intersection associated with a runway intended for use in:

a) runway visual range conditions less than a value of 550 m where a stop bar is not installed; and

b) runway visual range conditions of values between 550 m and 1 200 m where the traffic density is heavy.

10.4.20 As the number of operations continues to increase at many airports around the world, the opportunity for runway incursions also increases. As part of runway incursion prevention measures, Annex 14, Volume I also recommends that runway guard lights, Configuration A or Configuration B, should be provided at each taxiway/runway intersection where runway incursion hot spots have been identified, and used under all weather conditions during day and night.

10.4.24 The installation of runway guard lights, Configuration A, has been found useful to increase the conspicuity of stop bars installed at runway-holding positions associated with precision approach runways.

10.5.2 The selective switching of lighting is an important capability in the implementation of an A-SMGCS. The "ICAO Operational Requirements for A-SMGCS" assume the continuing use of this technique as a means of selectively indicating routes, providing dedicated guidance, and assisting the control function. **The selection can be done manually in response to visual observation from the control tower. In some cases, surveillance sensors can be used to assist the manual operation**. **In other cases a degree of automation may be introduced, as for example in the case of the <u>reactivation of a stop bar after a fixed time interval.</u>** The control of stop bars through the use of position sensors can be illustrated by the following example. It should be noted that the example given assumes certain ATC procedures. Different procedures require appropriate system designs to be developed.

10.5.3 Stop bars locations are provided with three aircraft position sensors as shown in Figure 10-2. Various types of position sensors, or a control signal from the A-SMGCS, can be used: position sensor 1, located across the taxiway and 70 m before the stop bar; position sensor 2, located across the taxiway and immediately after the stop bar; and position sensor 3, located across the runway and about 120 m beyond the threshold. When an aircraft is cleared to taxi for take-off, the pilot taxies following the taxiway centre line lights which remain on only up to the stop bar at the runway-holding position. When the aircraft crosses position sensor 1 (see Figure 10-2), a light appears on a special control board in the control tower. This advises the controller that an aircraft is nearing the stop bar and that the pilot is expecting clearance to enter the runway. To permit the aircraft to cross the stop bar (see Figure 10-3), the controller not only issues a clearance through radiotelephony but also switches off the stop bar by pressing a button. This automatically illuminates that part of the taxiway centre line lighting beyond the stop bar. **When the aircraft crosses position sensor 2 (see Figure 10-4), the stop bar is automatically switched on again to protect the runway.** When the aircraft commences the take-off run and crosses position sensor 3 (see Figure 10-5), that portion of taxiway centre line lighting between the stop bar and position sensor 3 is automatically switched off. In the event an aircraft crosses the stop bar without authorization from the controller, position sensor 2 serves as a safety barrier (see Figure 10-6) and the system alerts the controller both visually, through a light on the control board, and by sounding an alarm.

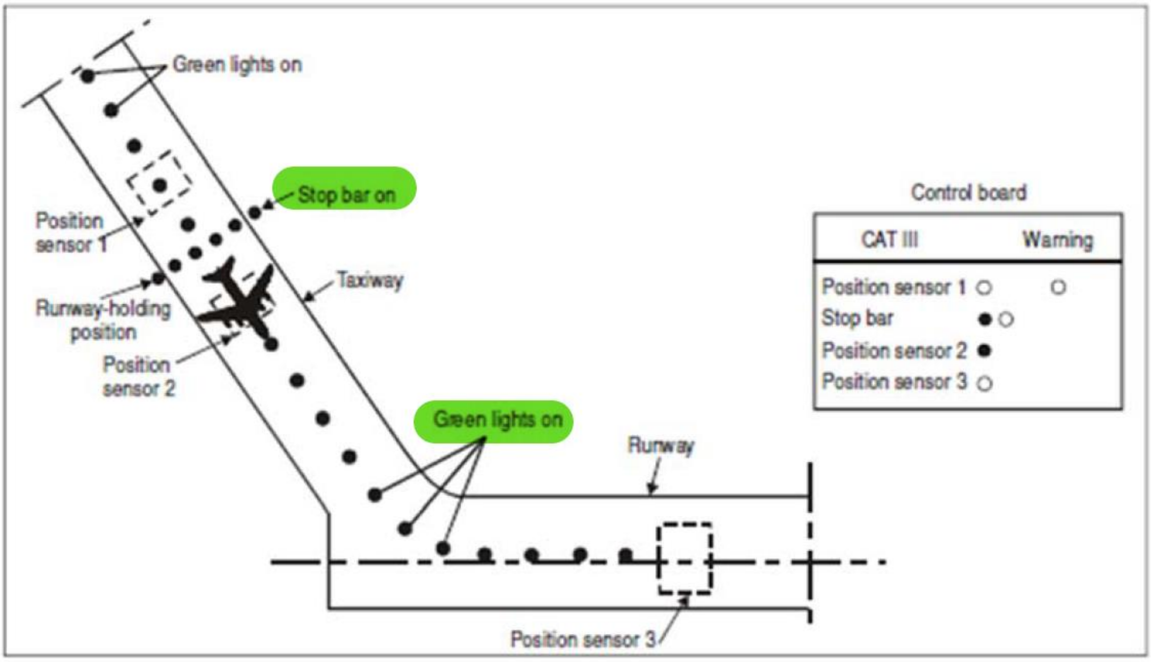


Figure 10-4. Control of stop bar through position sensors — Aircraft crossing position sensor 2

3. PROPOSAL AND DISCUSSIONS

CASE 1: Concerns when Interlocking provision is implemented as per ICAO ANNEX 14 SARPS clause 5.3.20.12(d)

When Interlocking provision is provided for the stop bars and the TCL's, when the Stop bars are ON and TCLs would be OFF and vice versa. For example, if the Stop bar is OFF either manually through a controlling system by any other mechanism the TCLs would be switched ON. When the Stop Bars are reactivated then TCLs would be off. This mechanism was implemented for many years where the technology of the individual lamp controlling and monitoring system (ILCMS) or any other automation is not really available.

The required time of 30 seconds as guided by ADM part -4 , visual Aids, shall be assessed by the airports and shall design the system accordingly. Some Airports may require higher duration which shall be analysed and through a structured approach the assessment need to be done. In any case during the transit of the Aircraft towards the runway, the required guidance which shall be provided by the TCL's shall not be compromised upon.

As per the ICAO Annex 14- SARPs:

5.3.23.1 Runway guard lights, Configuration A, shall be provided at each taxiway/runway intersection associated with a runway intended for use in:

a) runway visual range conditions less than a value of 550 m where a stop bar is not installed.

As per the above clause, the runway guards are not installed where stop Bar lights are provided. While as per the above discussion, in case of interlocking, if stop bars are in OFF condition and TCL's are in ON condition, if an Aircraft already in midst of covering the 90 metres section, the stop bars are in OFF condition. In this case, the next Aircraft which is lined up will be posed by following concerns:

i. Establishing the runway holding position as stop bars are OFF and no RGL's are present to at least assess the holding point. (Fig 1)

ii. The availability of TCLs without stop bars may give an impression of continuous availability of TCL, which might be interpreted as a regular taxiway as stop bar is OFF and RGLs are not available. (FIG 2)

Based on the above deductions, the presence of runway guard lights would make the pilot aware of the clear demarcation of the runway holding position, even when stop bar lights are not available.

Due to the above scenario, a probability exists for the runway incursion where the runway holding position is not guarded without any other visual guidance especially in the low visibility conditions, where runway guard lights not available and markings are not seen. Establishing the runway holding position in this case would be very tough for the aircraft.

TCLs are available when stop bar lights are OFF, the presence of flashing runway guard lights would indicate the need for taking the clearance from the ATC tower. Once the runway guard lights are available, he gets a clear indication of the presence of the runway holding position. Hence, provision of runway guard lights irrespective of STOP BAR lighting system availability would be advantageous w.r.t the safety and operational perspectives.

From clause 10.4.19 and 10.4.24 reference from ADM part 4 – visual Aids, the provision of runway guard lights irrespective of STOP BAR lighting system availability would be advantageous w.r.t the safety and operational perspectives.

Also, the clause does not speak on the runway guard light requirement when the RVR conditions are greater than 1200 mtrs. Considering the heavy density traffic conditions, the same might also be recommended to ensure that the runway holding position is clearly identified. However, when RVR conditions are between 550-1200 m, as in this case also, if airports prefer to operate the stop bar, RGLs might not be required, nevertheless the RGLs are still recommended to have in all the conditions.

Also, this would help the regular FOLLOW ME services and other maintenance vehicles to distinguish the runway holding position in all the conditions.

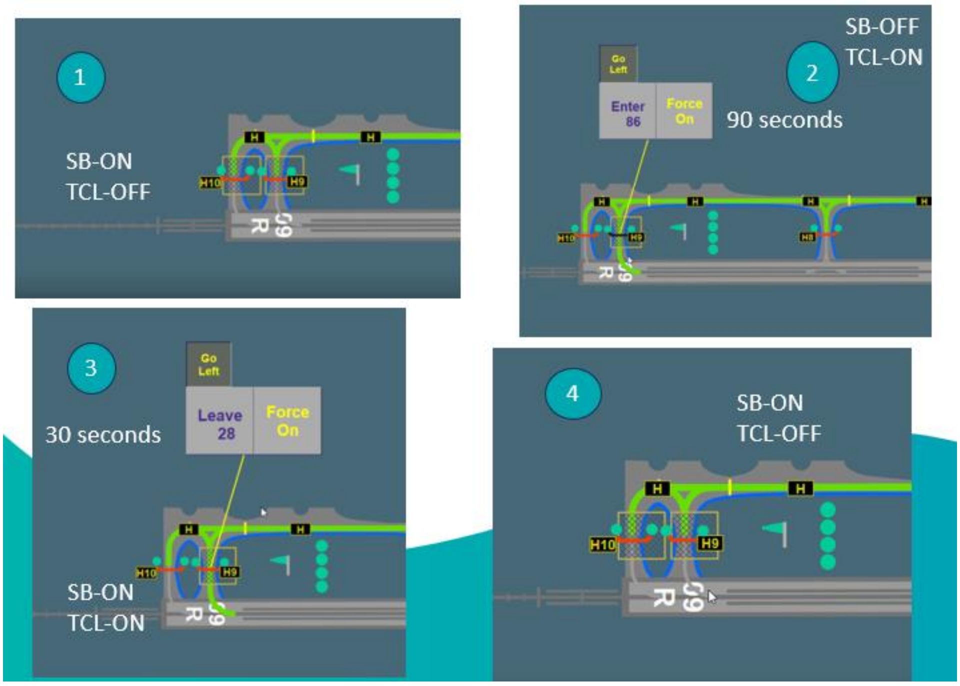
The below case discusses the time setting for the reactivation of STOP BAR which would be reviewed to ensure enhanced safety.

CASE 2: Review on time settings for the reactivation of STOP BARs

There is a certain period for the taxiways where the stop bars are OFF and the TCL's are ON (Step 2), for which no specific guidance is not available. While this could be a safety concern based on the set time for the Step 2.

For example, considering the entire sequence to be 120 seconds (Note: During this time the TCLs would be switched ON continuously for 120 seconds period of time) , if step 2 is set for 90 seconds and step 3 is for 30 seconds, there is 90 sec time available with the stop bar OFF condition, which means the next aircraft when entering, it does not have any reference position for holding without the guidance of the runway guard lights as he will be seeing continuous TCL guidance for 90 seconds. Considering that the minimum time required for the aircraft to cover the 90 metres TCL section is 30 seconds, in any case the probability of the next aircraft visualizing the STOP BAR OFF and TCL ON condition will be 60 seconds, which is a serious safety concern and can contribute to the runway incursions.

The time settings for the reactivation of stop bar to be limited to prevent such probabilities. In the previous example the stop bar reactivation time is 90 seconds, while the same can be reduced to 30 seconds in order to guide the next aircraft to STOP at the runway holding position. In this case along with having the required guidance of where to hold, the required guidance on the runway occupancy by the previous aircraft also can be visually guided through activation of stop bars at much earlier time.



Step 1- STOP BAR – ON AND TCL- OFF
Step 2- STOP BAR – OFF AND TCL- ON
Step 3- STOP BAR- ON AND TCL – ON
Step 4- STOP BAR- ON AND TCL -OFF

4. INFERENCES

4.1 Based on the above discussion, the following conclusions can be drawn.

4.2 From clause 10.4.19 and 10.4.24 reference from ADM part 4 – visual Aids and the discussion on the proposal, the provision of runway guard lights irrespective of STOP BAR lighting system availability would be advantageous w.r.t the safety and operational perspectives.

4.3 The time setting for the reactivation of STOP BAR may be reviewed to ensure safety can be enhanced further.

5. ACTION BY THE MEETING

5.1 The meeting is invited to:

a) note the information contained in this paper; and

b) review, discuss and recommend the following revisions in "Annex 14, Volume I, 5.3.23 Runway guard lights."

5.3.23.1 Runway guard lights, Configuration A, shall be provided at each taxiway/runway intersection associated with a runway intended for use in:

a) runway visual range conditions less than a value of 550 m where a stop bar is not installed; and

b) runway visual range conditions of values between 550 m and 1 200 m where the traffic density is heavy and where a stop bar is not installed

Note 1.— Runway guard lights, Configuration B, may supplement runway guard lights, Configuration A, when deemed necessary.

Note 2.— Guidance on the design, operation and location of runway guard lights, Configuration B, is given in the Aerodrome Design Manual *(Doc 9157), Part 4.*

5.3.23.2 **Recommendation.—***Runway guard lights, Configuration A, should be provided at each taxiway/runway intersection associated with a runway intended for use in:*

a) runway visual range conditions less than a value of 550 m where a stop bar is installed; and

b) runway visual range conditions of values between 550 m and 1 200 m where the traffic density is heavy and where stop bar is installed

c) runway visual range conditions of values greater than 1 200 m where the traffic density is heavy.

~~5.3.23.2~~ 5.3.23.3 **Recommendation.—** *As part of runway incursion prevention measures, runway guard lights, Configuration A or B, should be provided at each taxiway/runway intersection where runway incursion hot spots have been identified, and used under all weather conditions during day and night.*

~~5.3.23.3~~ 5.3.23.4 **Recommendation.—** *Configuration B runway guard lights should not be collocated with a stop bar.*

~~5.3.23.4~~ 5.3.23.5 Where more than one runway-holding positions exist at a runway/taxiway intersection, only the set of runway guard lights associated with the operational runway-holding position shall be illuminated.

—END—

INTERNATIONAL CIVIL AVIATION ORGANIZATION

REGIONAL GUIDANCE FOR THE DESIGN AND OPERATION OF ALTIPORTS

[DRAFT]

First Edition, ../../ 2024

This Guidance Material was developed by AP-ADO/TF and approved by the AOP/SG/.. Meeting and published by ICAO Asia and Pacific Office, Bangkok

RECORD OF AMENDMENTS

AMENDMENTS			
No.	Date Applicable	Date Entered	Entered by:

AMENDMENTS			
No.	Date Applicable	Date Entered	Entered by:

Table of Contents

CHAPTER 1. GENERAL

1.1 Introduction

1.1.1 This regional guidance material provides general guidance on altiport's site selection, physical characteristics, obstacle limitation surfaces and visual aids that should be provided at altiports, as well as certain facilities and technical services normally provided at conventional land aerodromes.

1.1.2 Stolport Manual (Doc 9150) defines an ALTIPORT as "a small airport in a mountainous area with a steep gradient runway, used for landing up the slope and for take-off down the slope, thereby making use of only one approach/departure area." (FOREWORD, para 4 refers)

1.1.3 Most of the Annex-14 Volume - I and Stolport specifications may not be applicable to altiports which are constructed in mountainous regions, though some of the STOL aeroplanes in use today are designed to operate from altiports.

1.1.4 As no standards and recommended practices (SARPs) for altiports exist in any of the ICAO documents, this guidance material covers all the aircraft operating aspects of altiports except non-visual navigation aids. The airport terminal building and ground side operations are not addressed in this document.

1.1.5 Since altiports are generally operated under visual meteorological conditions (VMC), the provisions described below are limited to this type of operation [6]:

a) An altiport has at least:

- a steeply sloped runway extended at the top by a low-sloped segment itself associated with a substantially horizontal platform comprising the waiting and parking areas; and/or
- a unique approach and take-off path, which itself is supported by the lower end of the runway strip.

b) The lower part of the steep slope of the runway can be usefully extended by a segment of less steep slope[1] allowing the pilot:

- to make contact more comfortable on landing;
- to have a better view of the end of the runway during the take-off roll prior to take-off;
- <u>to limit the length of the runway necessary for a maneuvering during the accelerating-stop in case of one engine failure while an aeroplane is in take-off run</u> [2].

c) The design of an altiport is based on the idea that, since take-off is downhill and landing is uphill, the steep segment of the runway is used as an additional factor of acceleration on take-off and deceleration on landing to reduce the length required for both, and thus allow an aerodrome to be located at the site to be served. This principal characteristic of altiport runways **<u>is not without posing important problems</u>** for the operation of

[1] *nevertheless, higher than the maximum permissible slope for the runways of conventional aerodromes.*
[2] *minimum requirement for multi-engine aeroplanes carrying more than ten passengers or having a maximum take-off mass of 5,700 kg or less.*

aeroplanes, the use of which are used in the domain of non-conventional flight.

d) The average longitudinal slopes that can be found on altiports are outside the correction ranges covered by the flight manual charts and would require large extrapolations, leading to **aeroplanes intended for use on altiports being subject to additional certification**.

e) However, for altiports intended to receive only light aeroplanes, a simplified method for determining their runway lengths will be used, as described in Attachment A, Section 1.

f) It should be noted that the classical definitions of take-off and landing on conventional runways do not apply to altiports, for which the passages at 35 ft for take-off and 50 ft for landing have no meaning, and that the length to be given to the runway only refers to the take-off speed at which the aircraft leaves the ground after having initiated its take-off roll as well as, possibly, to the accelerated-stop distance of the most critical aeroplane.

Notes: -

1) *At altiport an engine failure is not considered during take-off and climb out until reaching safety altitude of 400 ft above ground level (altiport elevation). Likewise, during approach an engine failure is not considered beyond missed approach point. (Refer to "Supplement No. 178R2 of LET410 UVP-E20, Page, 3, 6 & 8 of 18" [14])*

2) *If an engine fails after the decision speed is reached, the aeroplane will have sufficient speed and power available to complete the take-off safely in the remaining take-off distance available. However, because of the high speed, there would be difficulty in stopping the aeroplane in the remaining accelerate-stop distance available [2.3 of Section 2, Attachment A of Annex 14, Volume I].*

1.2 Altiport design aeroplanes

1.2.1 For the purposes of this guidance material, the altiport design aeroplane is assumed to be an aeroplane with short take-off landing (STOL) performances that has a reference field length of **800 m or less**. In size, the altiport design aeroplane is assumed to have a wingspan of **15 m up to but not including 24 m** and an outer main gear wheel span (OMGWS) of **4.5 m up to but not including 6 m**. In terms of maximum take-off mass, the altiport design aeroplane is assumed to have a maximum take-off mass of **5,700 kg or less**.

Note:-

STOL operations of Dornier 228 are limited for maximum take-off mass of 5,700Kg (Supplement No 1131, Dornier 228). However, such information is not available in Supplement No. 178R2 of L410 UVP-E20.

1.2.2 List of aeroplanes with STOL performance currently being operated at altiports in Indonesia and Nepal are provided in **Appendix 1**.

1.3 Definitions

Refer to *Annex 14 Aerodromes, Volume I Aerodrome Design and Operations* for definitions of terms used for land aerodromes.

When the following terms are used in this manual they have the following meanings:

Altiport. ~~A small airport~~ An aerodrome in a mountainous/hilly terrain with a short runway and a steep ~~gradient runway~~ longitudinal slope, used for landing up the slope and for take-off down the slope, thereby making use of only one approach/departure ~~area~~ path in most of the cases and where operations are possible only by aeroplanes with STOL performance capabilities.

Stolport. An airport whose physical characteristics, visual and non-visual aids and total infrastructure are created to support safe and effective public air transport in and out of densely populated urban areas as well as to and from rural areas with difficult terrain.

1.4 Applicability

1.4.1 This guidance material is meant for the use of altiport planners and the appropriate airport authorities in examining the feasibility of altiport operations at existing aerodromes or other sites and in the planning, design and approval of altiports. Interpretation of the material requires the exercise of discretion and the making of decisions, particularly by the airport authorities.

1.5 Site Selection

1.5.1 Before a commitment of resources is made to establish an altiport in a mountainous area, there should be recognized social, environmental, economic, and operational advantages over existing transportation systems. These advantages hinge on the potential of greatly reducing trip time by providing service from urban areas to remote mountainous areas.

1.5.2 An altiport with a short runway requires a protection of less airspace compared to that needed for conventional airport due to the possibility of providing steep obstacle limitation surfaces allowing a greater flexibility in locating the altiport site.

1.5.3 Once an altiport site is provisionally selected, planning authorities will have to consider the details of construction and application of altiport specifications. This consideration might include a series of demonstration flights. The flights would serve several purposes. The community would be reassured about the safety and compatibility of altiport operations; the effects of air turbulence caused by hills could be tested; and route structures and air traffic service (ATS) separation standards could be established.

1.5.4 At the same time, the site would be examined with respect to the provision/or availability of ground transportation up to the nearest possible location from the feasible altiport site, without which some advantage is lost. Another important consideration governing site selection is the nature and composition of the soil and subsoil upon which prepared surfaces will be supported and, in particular, the adequacy of drainage to prevent the erosion of surfaces. Detailed guidance on airport site evaluation and selection is given in the *Airport Planning Manual (Doc 9184), Part 1 – Master Planning*.

1.5.5 Lastly, having established an altiport location, planners will turn to the design using the descriptions provided in this manual to define the physical characteristics, obstacle limitation surfaces and visual aids. This guidance is contained in the following chapters.

CHAPTER 2. ALTIPORT DATA

2.1 General

2.1.1 *Annex 14, Volume I, Chapter 2* sets forth details of aerodrome data to be determined about aerodromes and reported to the appropriate aeronautical information services (AIS). Where applicable, these requirements should be met by an altiport.

2.1.2 Where the use of an altiport is restricted to a particular aeroplane type, the appropriate aeronautical information service should be informed.

2.1.3 Altiport data should be reported as prescribed in *Annex 15* and *PANS-AIM (Doc 10066)*.

CHAPTER 3. PHYSICAL CHARACTERISTICS

3.1 General

3.1.1 The planning of an altiport comprises the development of suitable physical characteristics to provide the necessary operating elements for services by the altiport design aeroplanes. In addition, capacity or the forecast rate of utilization should be considered by the planner. The maximum rate of use is dependent on such factors as demand, weather and air traffic control capabilities as much as on altiport features. Although the characteristics described in this chapter are meant only to provide safe and effective field lengths and clearances, it is likely, in light of such external factors, that an altiport whose physical characteristics conform to this chapter could handle any forecast frequency of service.

3.2 Runways

3.2.1 Orientation of runway

3.2.1.1 This guidance material is developed for design and operations of altiport to be used only in visual meteorological conditions and intended for use by day only.

3.2.1.2 It is anticipated that the configuration for the most altiports would be a single runway in which operations are restricted to landing uphill and taking off downhill and an associated parking area (Figure 3-1).

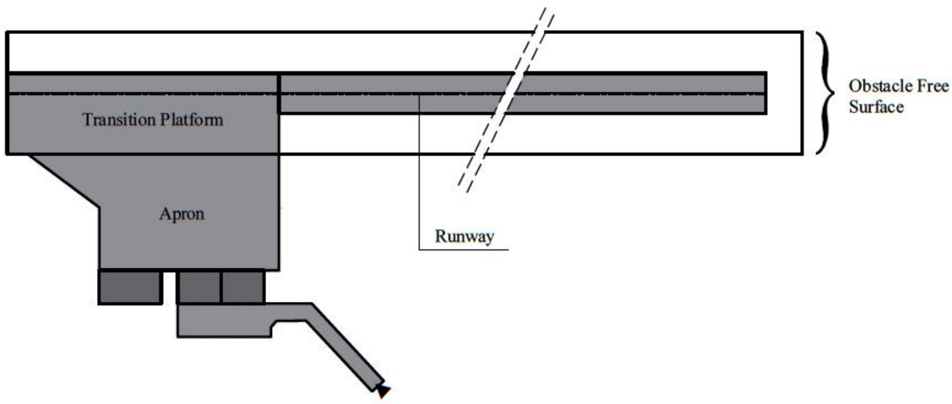


Figure 3 – 1: Schematic diagram of an altiport with paved runway

3.2.1.3 An altiport sites may lessen the opportunity for an ideal runway orientation in the direction of the prevailing wind due to topography of the site. Nevertheless, altiport design should aim for maximum usability factor and the orientation of the runway should take into account of crosswind limitation of the altiport design aeroplane. Guidance on factors to be taken into account in the study of wind distribution is given in *Annex 14, Volume I, Attachment A, Section 1*.

3.2.1.4 The decision on runway orientation should also take into account areas over which traffic will operate on approach, missed approach and departure so that obstructions in these areas or other factors will not unduly restrict operations.

3.2.2 Runway length

3.2.2.1 The length of an altiport runway should be determined using take-off and landing performance charts obtained from the aeroplane flight manual of the altiport design aeroplane and considered together with the following factors:

a) whether the approaches are open or restricted;

b) longitudinal slope of the proposed runway;

c) elevation of the site;

d) temperature and humidity of the site; and

e) nature of the runway surface.

3.2.2.2 When the appropriate aeroplane flight manual is not available the length of an altiport runway may be determined as described in **Section 1 of Attachment A**.

3.2.3 Clearways

3.2.3.1 Where a clearway is provided, an actual runway length less than that suggested by 3.2.2.1 may be considered satisfactory. In such a case any combination of runway, and clearway should meet the take-off and landing requirements of the altiport design aeroplane, taking into consideration the same factors as in 3.2.2.1. The guidance on the use of clearways given in *Annex 14, Volume I, Attachment A, Section 2,* is applicable to altiports.

3.2.4 Runway width

3.2.4.1 Detailed guidance for determination of runway width for altiport is provided in **Section 2 of Attachment A**.

3.2.4.2 For paved runways, the absolute minimum width of **18 m** is recommended for use in visual meteorological conditions and intended for use by day only.

3.2.4.3 For unpaved runways, the minimum width of the runway should be at least the width of the graded portion of the runway strip or **60 m**.

3.2.4.4 The site selection and orientation of a runway in the mountains is generally quite constrained, so particular attention must be paid to crosswinds in determining the width of the runway beyond the minimums thus recommended above.

3.2.5 Slopes on runways

Longitudinal slopes of the runway

3.2.5.1 The slope computed by dividing the difference between the maximum and minimum elevation along the runway centre line by the runway length should not exceed **10 per cent**.

3.2.5.2 Along no portion of a runway should the longitudinal slope exceed **15 per cent**.

3.2.5.3 The longitudinal slope of the upper segment of the runway (at least 1/6 of the length of the runway) should not exceed **3 per cent**.

3.2.5.4 The longitudinal slope of the lower segment of the runway (at least 1/3 of the length of the runway) should not exceed **3 per cent**.

Note:-

If landing is to be conducted downhill the slope (opposite direction compared to normal landings at altiports) due to excess tail wind and a favorable less steep slope of the runway, the length of the upper segment *of the runway should not be less than one-fourth of the length of the runway.*

Longitudinal slope changes

3.2.5.5 In longitudinal profile, the transition from:

a) the upper segment of the runway to the segment with the steep slope should be accomplished by a curved surface with a rate of change not exceeding 3.4 per cent per 30 m (minimum radius of curvature of 1,000 m); and

b) one slope to another slope at any segment of the steep sloped runway and between last segment of the steep sloped runway and lower segment of the runway should be accomplished by a curved surface with a rate of change not exceeding 0.85 per cent per 30 m (minimum radius of curvature of 4,000 m).

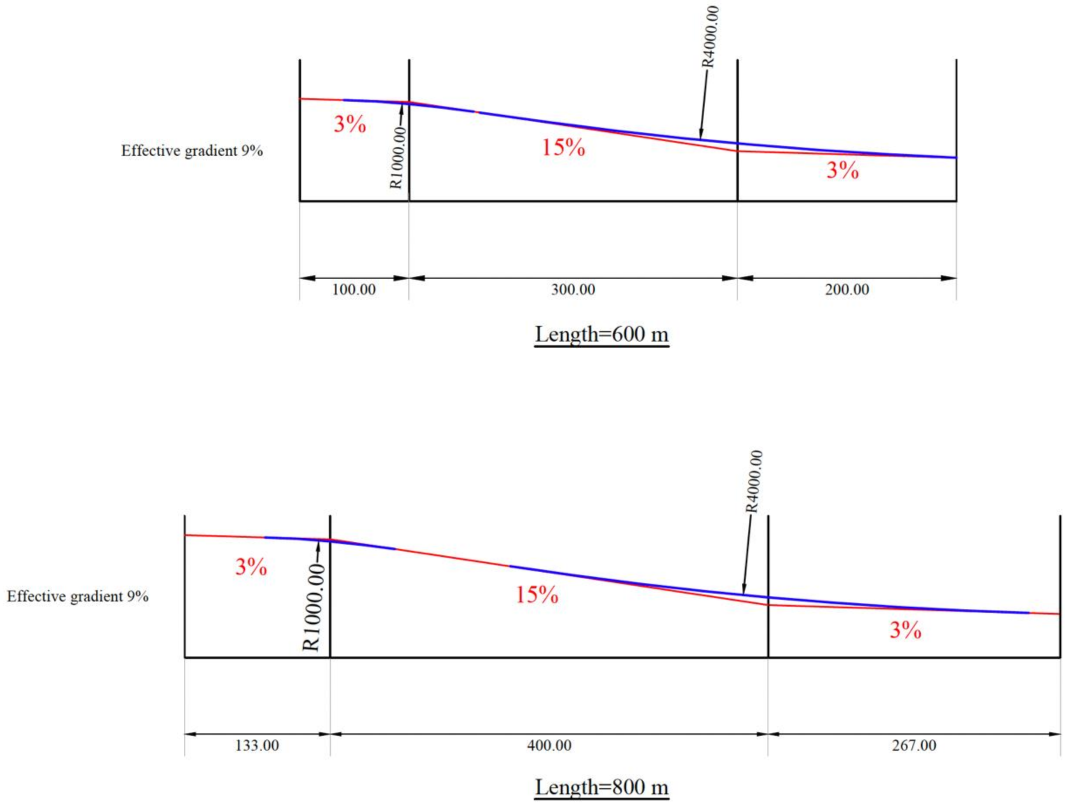


Figure 3 – 2: Schematic longitudinal profile of runway

Distance between slope changes

3.2.5.6 Undulations or appreciable changes in slopes located close together along a runway with steep slope should be avoided. The distance between the points of intersection of two successive curves should not be less than:

a) the sum of the absolute numerical values of the corresponding slope changes multiplied by minimum radius of curvature of 3,000 m; or

b) 45 m;

whichever is greater.

3.2.5.7 Guidance on implementing this specification is given in *Annex 14, Volume I, Attachment A, Section 4.*

Transverse slopes of runway

3.2.5.8 To promote the most rapid drainage of water, the runway surface should either be cambered or sloped from high to low in the direction of the wind most frequently associated with rain. A transverse slope should not exceed **2 per cent** for paved and **2.5 per cent** for unpaved runways. For a cambered surface the slope on each side of the centre line should be symmetrical.

3.2.5.9 The transverse slope should be substantially the same throughout the length of the runway except at the intersection with a taxiway where an even transition should be provided taking account of the need for adequate drainage.

3.2.5.10Guidance on transverse slopes is given in the *Aerodrome Design Manual (Doc 9157), Part 3*.

3.2.6 Strength of runways

3.2.6.1 A runway should have a bearing strength capable of supporting continual traffic of the altiport design aeroplane along the length of the declared take-off run or the declared landing distance, and throughout its full width.

3.2.6.2 A normal landing may impose little or no impact load on the landing surface. However, the load factors arising from an emergency, or a badly controlled landing should be considered.

3.2.7 Surface of runways

3.2.7.1 The surface of an altiport runway should be constructed without irregularities that would affect aeroplane performance during take-off or landing. Surface unevenness that would cause vibration or other control difficulties of an aeroplane should be avoided. Guidance on runway surfaces is given in the *Aerodrome Design Manual (9157), Part 3.*

3.2.7.2 Special attention must be paid to the construction of the upper layers, which is difficult due to the existence of a fairly steep slope. The possibility of more rapid erosion due to this slope should also be considered.

3.2.7.3 The texture of the surface of an altiport runway requires special attention in view of the short-field landing requirements. A rough texture surface that is conducive to braking should be used. Where aquaplaning from poor drainage is anticipated to be prevalent, considerations should be given to grooving the runway surface. A grooved surface has been shown to be effective in providing braking action on wet runways. Guidance on methods used to measure surface texture is given in the *Airport Services Manual (9137), Part 2*, while guidance on grooving runways is contained in the *Aerodrome Design Manual (9157), Part 3*.

3.3 Runway strips

3.3.1 General

3.3.1.1 The runway should be included in a runway strip. The purpose of a runway strip is to provide for the following operational considerations:

a) a graded area for aeroplanes accidentally running off the runway;

b) a cleared area for aeroplanes drifting from the runway after take-off;

c) a cleared area for aeroplanes carrying out a missed approach;

d) an area for the installation of essential visual aids; and

e) an area for drainage and run-off from the runway.

3.3.2 Runway strip width and length

3.3.2.1 A runway strip is an area free of any obstacle containing at least the runway including its upper segment and the lower segment.

3.3.2.2 To allow the best use of the whole length of the runway, it is recommended to extend the strip beyond the upper end of the paved runway by **a length at least equal to half of the maximum wingspan** of the critical altiport design aeroplane.

3.3.2.3 In the case of a paved runway only, the strip shall extend **30 m** beyond the lower end of the runway.

3.3.2.4 An altiport runway strip width of at least **30 m** on either side of the runway centre line is adequate for day-time operations in visual meteorological conditions.

3.3.3 Graded areas

3.3.3.1 To provide for a) in 3.3.1.1, the portion of a runway strip outside the runway and within a distance of **30 m** from the centre line of the strip should be graded. The surface of that portion of the runway strip that abuts the runway edge should be flushed with the surface of the paved runway.

3.3.3.2 To protect a landing aeroplane from the danger of an exposed edge, the runway strip should be prepared against blast erosion to at least **30 m** before the start of a runway.

3.3.3.3 Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed after the graded portion of a runway strip and would be placed as far as practicable from the runway.

3.3.4 Longitudinal and transverse slopes of runway strips

3.3.4.1 The longitudinal slope of the lateral parts of the strip should preferably be identical to that of the runway.

3.3.4.2 When carried out, snow and ice removal must be done on the width of the paved runway. A 0.50 m difference in level at the edge of the runway followed by a 15% upward slope to the lateral limit of the strip may be allowed on both sides [6].

3.3.4.3 When the runway **-** whether paved or unpaved **-** is only groomed, the grooming must be carried out over a minimum width of 30 m, beyond which an upward slope, at a maximum of 15 %, will be extended up to the lateral limit of the strip [6].

3.3.4.4 The transverse slopes on runway strips should conform to those specified in *Annex 14, Volume I*, for a strip associated with a runway with code number 1.

3.3.5 Objects on runway strips

3.3.5.1 For safety considerations, no object, unless essential as an aid to air navigation, should be installed on a runway strip. Air navigation equipment that must be located on a runway strip should be marked, be of minimum mass and height, and frangibly designed so as to constitute the minimum hazard to aircraft. Frangibility requirements are set out in *Annex 14, Volume I, Chapters 3, 5 and 9.*

Note.— Guidance on design for frangibility is contained in the Aerodrome Design Manual (Doc 9157), Part 6.

3.4 Taxiways

3.4.1 General

3.4.1.1 As mentioned in 3.2.1.2, the likely configuration of an altiport is a single runway served by taxiway (s) (if provided) or upper transitional platform to link the apron (See Figure 3 - 3 and Figure 3 – 4).

3.4.1.2 A taxiway should be designed so that when the cockpit of the design aeroplane is over the taxiway centre line markings, the clearance distance between the outer main wheel of the aeroplane and the edge of the taxiway should not be less than **2.25 m**.

3.4.1.3 When designing taxiways at an altiport, the specifications should conform to the Standards and Recommended Practices described in Annex 14, Volume I, Chapter 3. Guidance on design of taxiways is given in the *Aerodrome Design Manual (9157), Part 2*.

Figure 3 - 3: Taxiway linking to apron (Alpe d'Huez Airport, France)

3.5 Aprons

3.5.1 General

3.5.1.1 It will be necessary to provide an apron to permit the loading and unloading of passengers and cargo as well as aircraft servicing without interfering with altiport traffic. The distance from the edge of an apron to the edge of a runway strip should be sufficient for an aeroplane parked on the apron not to penetrate the transitional surface.

3.5.1.2 The upper platform of an altiport consists of:

- the upper part of the runway that can be used for landing or take-off maneuvers;
- a transitionl platform (or holding area as shown in Figure 3-4) where aircraft perform engine tests at the start up point, which can also be used as a turning pad, or a taxiway link (as shown in Figure 3-3); and
- the apron (aircraft parking area).

3.5.1.3 These components can be unpaved or paved.

3.5.1.4 Except on the upper segment-of the runway, which may be sloped up to **3 per cent**, the slope of the upper platform shall not exceed **2 per cent** in any direction. On an aircraft parking stand area, the maximum slope should not exceed **1 per cent**.

3.5.1.5 Where it is practically not possible to locate the apron at the upper platform the apron with taxiway may be located at other appropriate places if the topography and the longitudinal slope of runway permit (as shown in Figure 5-1).

Figure 3 – 4: Transition platform (Courchevel Altiport, France)

3.5.1.6 Side-by-side parking of aeroplanes and helicopters is not recommended. Since helicopters frequently use the altiports[3], it is recommended to reserve a specific parking area for them.

3.5.1.7 The Figures 3 -1 and Figure 3 – 2 show a schematic diagram of an altiport with a paved runway as well as the longitudinal profile of the runway in its simplest configuration.

3.5.2 Size of aprons

3.5.2.1 The necessary altiport capacity to handle planned or predicted altiport traffic will be the main determinant in establishing an apron's size. An apron's size should be sufficient to contain an adequate number of aircraft parking bays or spaces to cater to the altiport's traffic volume at its highest level.

3.5.2.2 As the number of aircraft parking bays or spaces required will depend, in part, on parking bay occupancy or turnaround time, aircraft operators intending to use the altiport should be consulted with respect to scheduling and other matters that affect the time an aeroplane needs to occupy the apron.

3.5.2.3 The size of an apron will also be governed by the size of the altiport design aeroplane and the parking method selected for use on the apron. While nose-in parking uses less space, economy and convenience will probably dictate self-manoeuvring, angled nose-in or angled nose-out parking. Figure 3-3 depicts a typical altiport apron.

[3] *In this case, the helicopters do not use the steep runway but a final approach and take-off area specifically dedicated to them.*

Figure 3 – 5: Example of typical altiport apron (Tenzing Hilary Altiport, Lukla, Nepal)

3.5.3 Strength of aprons

3.5.3.1 An apron should have sufficient bearing strength to support the mass of the altiport design aeroplane, keeping in mind that parts of the apron will be subject to higher stresses owing to slow moving and stationary aeroplanes and other vehicles/equipment.

3.5.4 Slopes of aprons

3.5.4.1. The slopes of an apron should be sufficient to prevent accumulation of water but should not exceed **1 per cent** in any direction.

3.5.4.2. Because of the possibility of spilled fuel and the ensuing fire hazard, an apron should not slope down towards a terminal building.

CHAPTER 4. OBSTACLE LIMITATION SURFACES

4.1 General

4.1.1 Obstacle limitation surfaces are established to define the airspace over and around an altiport that must be kept free of obstacles. The obstacle limitation surface sets out the limits above which objects should not extend.

4.1.2 In the planning and design of an altiport, obstacle limitation surfaces require careful consideration. In fact, the presence of objects located in the vicinity or planned for construction near an otherwise suitable altiport site may be the overriding factor in whether an altiport will be a realistic project. The operation of an altiport may be significantly affected by features beyond the altiport boundary such as buildings, bridges and towers or mountains, hills etc. Objects that penetrate the obstacle limitation surfaces described in this chapter may, therefore, impose take-off mass limitations, cause an increase in weather minima or both. They may also necessitate the displacement of the threshold.

4.1.3 Once a commitment is made to the establishment of an altiport, the sectors of the local airspace covered by the obstacle limitation surfaces should be regarded as integral to the altiport and therefore inviolable. Consequently, enactment of zoning legislation may be needed to preserve unobstructed airspaces for take-off, approach, missed approach and circling procedures. Legislation aside, the altiport authorities should be involved in community consultation and should maintain close liaison with local development planners to ensure that altiport requirements are included in forecasts and well-integrated into plans.

4.1.4 Altiport obstacle limitation surface requirements are normally set on the assumption that take-offs and landings will be made in a single direction. Therefore, the functions of surfaces may be integrated and the requirements of one surface nullified because of the more stringent requirements of another.

4.1.5 The obstacle limitation surfaces to be defined at an altiport will depend on terrain and the type of operation envisaged at the altiport. At the very minimum, for daytime operations in visual meteorological conditions, the surfaces requiring protection are the take-off and approach surfaces and the transitional surface.

4.1.6 Obstacle limitation surfaces (OLS), specified in Annex 14 Volume I for aerodromes reference code 1are not suitable for altiports.

4.1.7 Criteria for evaluating obstacles are contained in the *Procedures for Air Navigation Services - Aircraft Operations PANS OPS (Doc 8168,*) Volume II - Construction of Visual and Instrument Flight Procedures.

4.2 French practices for altiport OLS

4.2.1 The variety of runway configurations that can be encountered means that the obstacle limitation surfaces for an altiport can only be chosen after a study of the approach and departure procedures of the aeroplane.

4.2.2 The description given below of the obstacle limitation surfaces associated with a unique approach and take-off path is therefore only indicative and is only intended to provide guidance for altiport planners.

Approach/take-off surfaces

4.2.3 The characteristics in the shape and size of the obstacle limitation surfaces indicate that there is not any difference between approach/take-off surfaces.

4.2.4 The longitudinal profile of the centreline of the approach/take-off surface as shown in Figure 4 - 1 is generally characterized by:

a) a segment Δ_1 originating at lower side of the strip and having a negative slope at least as steep as that of the centreline of the lower segment of the runway (if slope of centreline of the lower segment of the runway is horizontal or positive then the slope should be equal to the runway strip);

b) a horizontal segment Δ_2; and

c) a segment having positive slope Δ3, the length of which is sufficient for the aircraft on take-off to clear the surrounding obstacles.

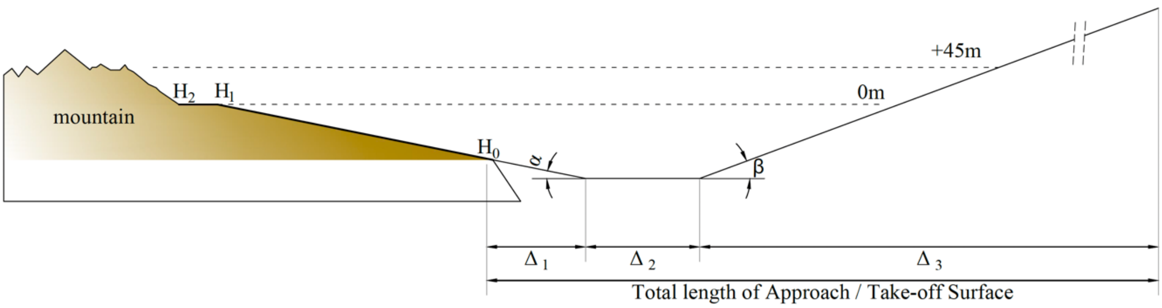


Figure 4 – 1: Longitudinal profile of the approach/take-off surface

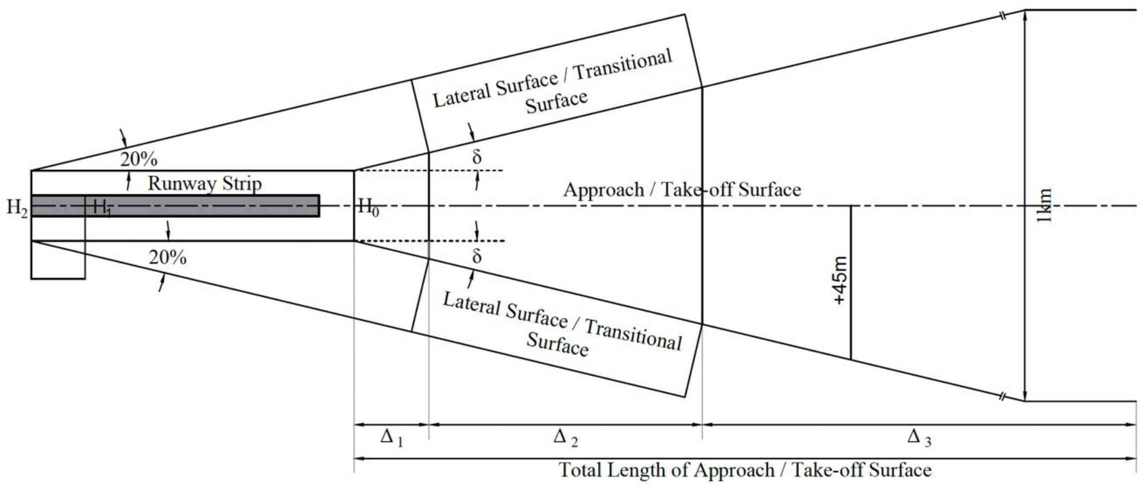


Figure 4 – 2: Plan of altiport approach/take-off surface and lateral/transitional surface

4.2.5 Since the total length of the approach/take-off surface must not be less than **2,000 m**, the values of Δ1, Δ2 and Δ3 will be set on a case-by-case basis according to:

a) the reference code corresponding to the most critical design aeroplane to be served by the altiport to select the slope (β); and

b) the operating constraints specific to the site studied.

<u>Note:</u> *The value of β may be taken 6% or 15:1 as per STOLPORT manual.*

4.2.6 The plan view of Approach and Take-of Surface is shown in Figure 4-2 and is generally characterized by:

a) an inner edge of specified length (equal to width of runway strip), horizontal and perpendicular to the extended centre line of the runway and located at the outer end of the strip;

b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate (with the divergence δ being at least **20 per cent** but never exceeding the value of 30 per cent**)** from the extended centre line of the runway until it reaches **1 km**;

c) an outer edge parallel to the inner edge, and beyond that, the width of the approach and take-off surface remains constant and equal to 1 km;

d) the above surfaces shall be varied when lateral offset, offset or curved approaches are utilized, specifically, two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the lateral offset, offset or curved ground track;

e) the elevation of the inner edge shall be equal to the elevation of the midpoint of the threshold; and

f) the slope(s) of the approach surface shall be measured in the vertical plane containing the centre line of the runway and shall continue containing the centre line of any lateral offset or curved ground track.

Transitional Surfaces (Lateral Surfaces)

4.2.7 The transitional surfaces consist of two surfaces at either side of the runway. The lower and upper limits of these Transitional (Lateral) Surfaces, are:

a) on the lower edge, the limit is defined by the length of the strip along the edge of the strip and from there extending along the bottom of the approach/take-off surface up to the first two segments of longitudinal profile (Δ1 and Δ2 and) defined above; and

b) on the upper edge, the horizontal lines originating from the upper corners of the strip and forming a divergence of **20 per cent (**but never exceeding the value of 30 per cent) with the vertical plane containing the runway centreline.

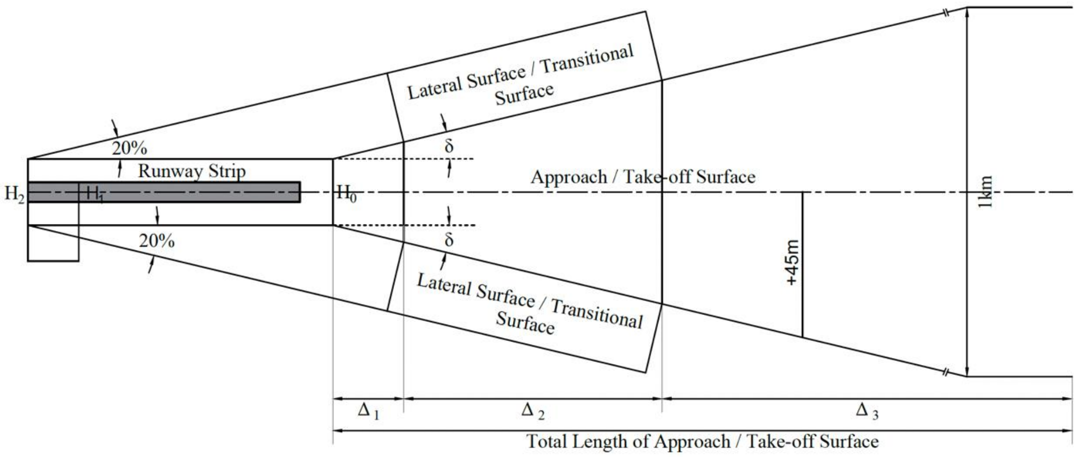


Figure 4 – 3: Plan of altiport approach/take-off surface and lateral/transitional surface

Inner horizontal surface

4.2.8 The selected site must also allow an aeroplane to make a low-level circling over the facilities before landing in order to ensure, if necessary, that the runway is clear on its upper segment.

4.2.9 The conditions of circling will also be the subject of a specific study, the conclusions of which will be associated with the extent of an inner horizontal surface. This surface will be positioned at a minimum height of 45 m, measured from upper platform, this surface will cover an area within a circular sector, centered on the upper platform, with a radius of 2,000 m and with sufficient opening (at least minimum of **65 degrees** towards each side of the runway centreline) to allow circling of a critical aircraft selected for the altiport.

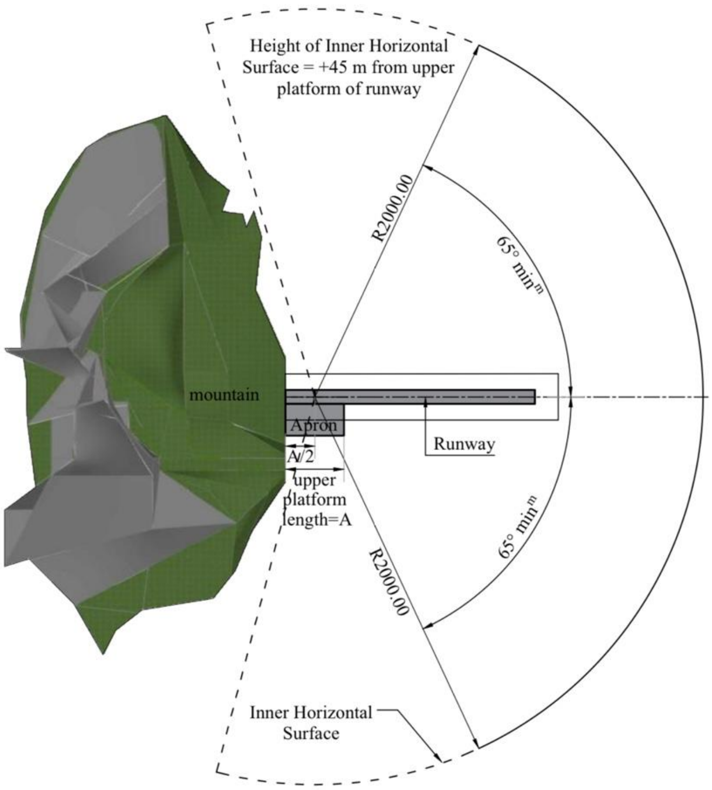


Figure 4 – 4: Inner Horizontal Surface

Missed approach surfaces

4.2.10 It is also recommended to provide a missed approach surfaces to protect the missed approaches.

4.2.11 When the terrain permits this missed approach surfaces can be constructed to be aligned as an extension of the runway (in the case of altiport with mountain pass) as shown in Figure 4-5 below. Its characteristics (width, slope and divergence) of lower edge will match with the take-off climb surface of a runway with normal characteristics (on conventional aerodromes) accommodating the same types of aircraft.

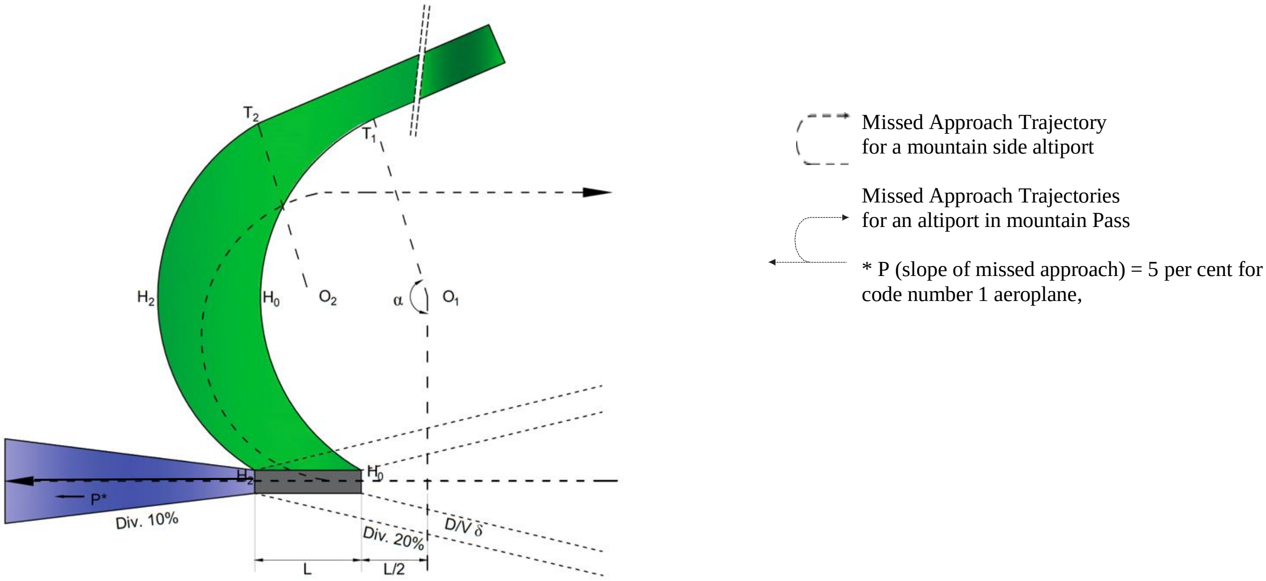


Figure 4 – 5: Missed approach surfaces (Plan)

4.2.12 However, when the terrain does not allow the missed approach to continue along the extension of the runway (e.g. altiports on the side of a mountain), the missed approach can only be carried out laterally (See Figure 4 – 5 with curved missed approach surface and Figure 4 –6).

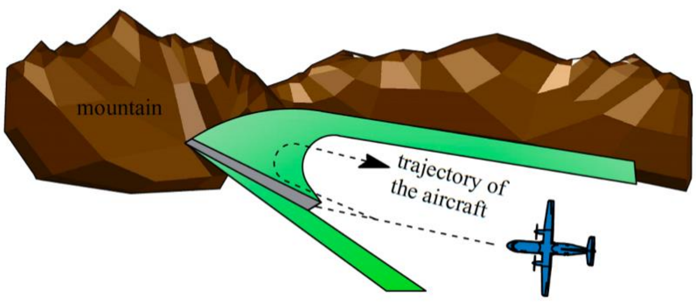


Figure 4 –6: Missed approach surfaces at altiport on a mountain side

4.2.13 The obstacle limitation surfaces protecting the missed approach should be constructed as shown in Figure 4-5, on the side where the missed approach is to be carried out:

a) the horizontal half-plane having elevation H_o as of the lower end of the strip;

b) the defined surface (cylindrical then flat) whose origin will be contained in a plane parallel to the center line of the runway and whose directions will be successively:

i. two horizontal arcs of a circle with elevations Ho and H2 (the latter being that of the upper side of the runway strip), each having a radius of at least 600 m, tangent to the plane containing centreline of the runway and the arc length of sectors (of circles) will be equal to the minimum angle (α) of the turn (depending on the terrain) to be carried out by the aircraft; and

ii. the horizontal tangents at the end of each of these two arcs (as shown in Figure 4 – 5 **as T1 and T2**).

4.2.14 The circular arc at elevation Ho should be centered at the extended runway centre line at a distance equal to one-half of the length of its main segment with a steep slope, from its lower end.

4.2.15 The arc at elevation H_2 shall be centred at the midpoint of the runway centre line.

4.2.16 As far as possible, this lateral missed approach surface should complement the missed approach surface along the extended centerline of the runway as shown in Figure 4-7, when the latter can be provided.

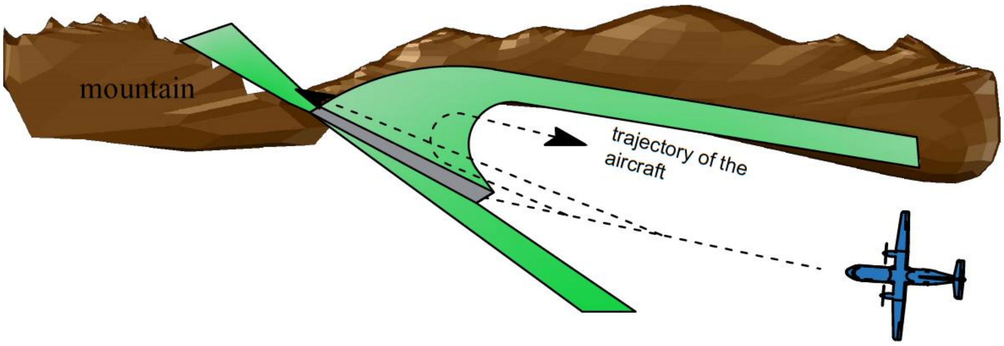


Figure 4 – 7: Missed approach surfaces at altiports in mountain pass or on dome shaped landforms

CHAPTER 5. VISUAL AIDS FOR NAVIGATION

5.1 General

5.1.1 In general, the specifications of Annex 14 Volume I for indicator and signalling devices, markings, lights, signs and markers are applicable for altiports.

5.1.2 Centre line marking is optional for unpaved runways; however, it may be necessary, at least on the upper part of the runway, to compensate for the lack of visibility caused to the pilot by the change of slope at the beginning of the rolling phase before take-off.

5.1.3 When an altiport is kept in operation without being cleared of snow, the edges of its runway will be marked with red flags spaced **25 m** apart.

5.1.4 Since an altiport can be subject to rapid variations in wind direction and intensity, it is necessary to have a windsock near the holding area for aeroplane taking off, and another at the runway threshold for aeroplane landing, since the conditions at these two points can be very different.

5.1.5 The visual aids provided at an altiport must serve to provide the pilot with the elements of guidance required to execute safe operations at the altiport.

5.2 Markings

5.2.1 The markings described in this chapter are suitable for altiport operations in visual meteorological conditions. Markings should be conspicuous and provide the maximum possible contrast under various conditions.

5.2.2 Runway markings should be white; taxiway and aircraft stand markings should be yellow and of a consistency that will reduce the risk of uneven braking.

5.3 Runway markings

5.3.1 Runway designation marking

5.3.1.1 A runway designation marking should be provided at the thresholds of a paved and unpaved runway as practicable. It should consist of a two-digit number that is the whole number nearest the one tenth of the magnetic azimuth of the centre line of the runway measured clockwise from magnetic north when viewed from the direction of approach. However, where an altiport is located in an area of compass unreliability a runway designation marking should display true azimuth rather than magnetic azimuth. Runway designation marking shall be in accordance with Annex 14, Volume I, Chapter 5, 5.2.2 as applicable.

5.3.2 Threshold marking

5.3.2.1 A runway threshold should be marked on paved runway with a series of white stripes **15 m** long, **1.8 m** wide, spaced 1.8 m apart located at the runway end.

5.3.2.2 A runway threshold marking should consist of a pattern of longitudinal stripes of uniform dimensions disposed symmetrically about the centre line of a runway. The number of stripes should be **4** for the runway width 18 m.

5.3.2.3 Where the threshold of an altiport runway is a displaced threshold, the beginning of the altiport runway should be indicated by a transverse stripe at least **1.8 m** wide. The portion of the runway before the displaced threshold should be marked with arrows and all other markings should be obliterated.

5.3.2.4 The arrows leading to a displaced threshold should be spaced at intervals of **30 m** with the point of the arrow immediately preceding the displaced threshold at **30 m** from the transverse stripe.

5.3.2.5 Guidance on the form and dimensions of the arrows are set out in Figure 5-4 A and B of *Annex 14, Volume I.*

5.3.3 Aiming point marking

5.3.3.1 An aiming point marking for paved runway should be provided at **150 m** from the threshold.

5.3.3.2 An aiming point marking should consist of two conspicuous stripes. The length of the stripe should be **30 – 45 m** and width of the stripe should be **4 m** and the lateral spacing between their inner sides should be 6 m.

5.3.4 Runway centre line marking

5.3.4.1 The runway centre line marking for paved runway should be in accordance with Annex 14, Volume I, Chapter 5, 5.2.2 as applicable.

5.3.5 Runway side stripe marking

5.3.5.1 A runway side stripe marking on paved runway should be provided between the thresholds of a paved runway where there is a lack of contrast between the runway edges and the shoulders or the surrounding terrain. A runway side stripe marking should consist of two stripes, one placed along each edge of the runway with the outer edge of each stripe approximately on the edge of the runway. A runway side stripe should have an overall width of at least **0.45 m**.

5.4 Taxiway marking

5.4.1 The taxiway edge and/or centerline markings should be provided in an altiport. The taxiway markings specified in Annex 14, Volume I, Chapter 5, are considered suitable for altiports.

5.4.2 At an intersection of a taxiway with a runway where the taxiway serves as an exit from the runway, the taxiway centre line marking should be curved into the runway centre line marking. The taxiway centre line marking should consist of a continuous yellow line **15 cm** wide parallel to and **1.8 m** from the runway centre line marking for **30 m** curving at a specified radius to join the taxiway centre line as shown in *Figures 5-6 of Annex 14, Volume I*. The turning radii of the taxiway centerline marking at the intersection of runway and taxiway should be **30 m** at **90 degree** exits.

Figure 5 – 1: Runway marking at Phaplu Airport, Nepal

5.5 Wind direction indicator

5.5.1 Since an altiport can be subject to rapid variations in wind direction and intensity, it is necessary to have a windsock near the holding area for aircraft taking off, and another at the runway threshold for aircraft landing, since the conditions at these two points can be very different. The specifications for wind direction indicators in *Annex 14, Volume I, Chapter 5*, are considered suitable for altiports.

5.6 Signs

5.6.1 General

5.6.1.1 Signs may be provided at an altiport to give information or instructions. The guidance on the sizes of signs, their inscriptions, methods of illumination, location, abbreviations commonly used and frangibility of signs given in the *Aerodrome Design Manual (Doc 9157), Part 6*, is applicable to signs at altiports.

5.6.1.2 A sign should be located as near to the edge of the pavement as possible. Signs should be lightweight and frangibly designed and mounted sufficiently low to preserve clearance with any overhanging part of the critical aeroplane.

5.6.1.3 Only mandatory signs on a movement area should use the colour red for background. A sign should be legible from the cockpit of an aeroplane at the farthest point of viewing.

5.6.2 Mandatory instruction signs

5.6.2.1 When provided, mandatory instruction signs should comprise runway holding position signs and NO ENTRY signs. A NO ENTRY sign should be located at the beginning of an area to which entry is prohibited.

5.6.2.2 Wherever possible, runway holding position signs and NO ENTRY signs should be located on each side of a taxiway facing the direction of approach to the runway or prohibited area. Where for some reason only one sign is utilized, it should be located any side (left or right) wherever feasible.

5.6.2.3 A mandatory instruction sign should consist of a white inscription on a red background.

5.6.2.4 Where applicable, the mandatory instruction sign inscriptions set forth in *Annex 14, Volume I,* *Chapter 5, 5.4.2*should be used.

5.6.3 Information signs

5.6.3.1 Given the compressed area and simplicity of a typical altiport, little use of information signs is foreseen. Where required, an information sign should convey information such as a specific location or destination on a movement area. Whenever possible an information sign on a taxiway should be located any side of the taxiway (left or right) wherever feasible.

5.6.3.2 An information sign should consist of either black inscriptions on a yellow background or yellow inscriptions on a black background.

5.6.3.3 Where applicable, the information sign inscriptions set forth in *Annex 14, Volume I, Chapter 5, 5.4.3* should be used.

5.7 Markers

5.7.5 General

5.7.5.1 Markers should be lightweight and frangibly mounted. Those located near a runway or taxiway should be sufficiently low to preserve clearance with any overhanging part of the critical aeroplane. Guidance on the frangibility of markers is given in the *Aerodrome Design Manual (Doc 9157), Part 6.*

5.7.6 Unpaved runway edge and runway strip markers

5.7.6.1 On unpaved runways, where the runway strip is not maintained to normal grading standards, the runway must be marked using edge markers, except that runway edge markers may be omitted if the full width of the runway strip is maintained suitable for aeroplane operations and the runway strip is marked using strip markers. Where the runway is not provided with edge markers, the threshold locations need to be marked appropriately in the shape of a └── ──┘ as shown in Figure 5-2 and Figure 5-3.

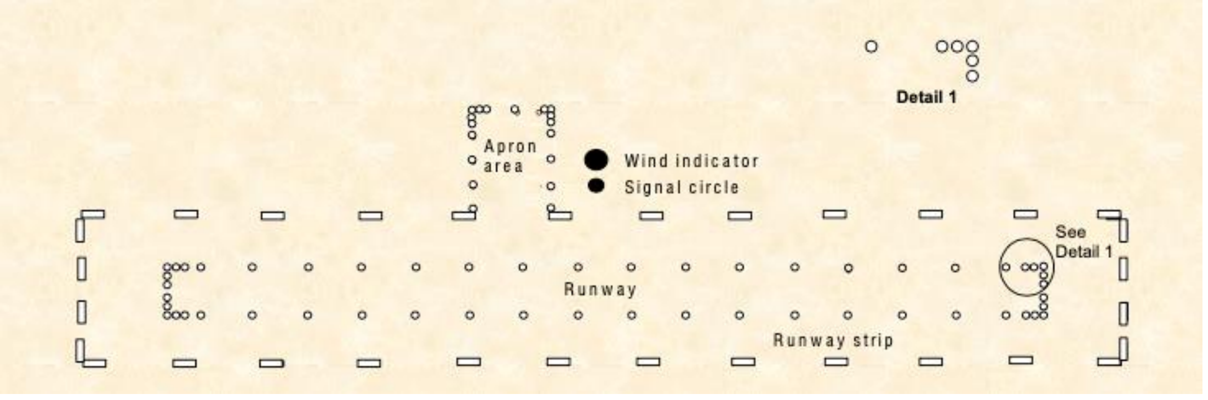


Figure 5 – 2: Runway and runway strip markers

5.7.6.2 Markers of conical shape for runway and markers of flat rectangular shape for runway strip should be used to clearly delineate the runway and runway strips limits on unpaved runways.

5.7.6.3 If flat rectangular markers are used to delineate the limit of the runway strip, they should measure at least **1 m** wide by **3 m** long and be placed with the longer dimension parallel to the runway centre line. If conical markers are used to delineate the runway limit, they should not be more than **30 cm** high and **0.4 m** base diameter.

5.7.6.4 The runway strip should be marked by using cones, gable markers or tires. Runway strip cone markers should have a **0.75 m** base diameter and be **0.5 m** in height. Gable markers should be **3 m** in length.

5.7.6.5 Cone or similar size markers need to be spaced not more than **90 m** apart. Gable or similar size markers need to be spaced not more than **180 m** apart.

5.7.7 Edge markers for snow covered runways

5.7.7.1 When the limits of a snow-covered runway are not otherwise indicated, it is recommended that edge markers should be provided. Edge markers for snow covered runways should be placed along the edges at intervals of not more than **90 m** and far enough from the centre line to not interfere with aeroplane on the runway. The threshold and end of the runway should be marked.

5.7.7.2 Evergreen trees **1.2 m to 1.5 m** high or other conspicuous, lightweight markers are appropriate to be used as edge markers for snow covered runways.

5.7.8 Unpaved taxiway edge markers

5.7.8.1 Taxiway edge markers should be provided where the limits of an unpaved taxiway are not obvious, and taxiway centre line markers are not provided.

5.7.8.2 A taxiway edge marker should be retroreflective blue. The marked surface as viewed by the pilot should be rectangle and should have a minimum viewing are of **150 cm²**.

5.7.8.3 Taxiway edge markers should be frangible. Their height should be sufficiently low to preserve clearance for propellers.

Figure 5 – 3: Example of Runway and Threshold markers

CHAPTER 6. VISUAL AIDS FOR DENOTING OBSTACLES

6.1 Objects to be marked and lighted

6.1.1 The marking and/or lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of obstacles. It does not necessarily reduce operating limitations which may be imposed by an obstacle.

6.1.2 A fixed obstacle that extends above an approach, or take-off climb surface within **2,000 m** of the inner edge should be marked and lighted except that:

a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle; and

b) the marking may be omitted when the obstacle is lit by day by high intensity obstacle lights.

6.1.3 A fixed obstacle above an inner horizontal surface should be marked and lighted except that:

a) such marking and lighting may be omitted when:

1) the obstacle is shielded by another fixed obstacle;

2) For an inner horizontal surface extensively obstructed by immovable objects or terrain, circling procedures have been established to ensure safe vertical clearance below the circling flight paths; or

3) the appropriate authority determines that the obstacle has no operational significance through an aeronautical study; and

b) the marking may be omitted when the obstacle is lit by day by high intensity obstacle lights.

6.1.4 Mobile equipment and vehicles, other than aircraft, on the movement area of an altiport are obstacles and should be marked and lighted except that equipment and vehicles used only on aprons may be exempt.

6.2 Marking and lighting of objects

6.2.1 Objects should be marked and lighted in accordance with *Annex 14, Volume 1, Chapter 6, 6.2*.

CHAPTER 7. VISUAL AIDS FOR DENOTING RESTRICTED USE AREAS

7.1 Closed runway and taxiway marking

7.1.1 Markings denoting a closed runway should be placed at each end of the runway and along the runway at intervals of not more than **300 m**.

7.1.2 Markings denoting a closed taxiway should be placed at each end of the taxiway or part of the taxiway that is closed,

7.1.3 Closed runway and taxiway markings should be painted on the surface if permanent but may be made of other materials if the closing is temporary. The marking should be in the form of an **"X"**, each arm of which should be at least **6 m** long and **0.9 m** wide as shown in Figure 7-1 of *STOLPORT Manual (Doc 9150)*.

7.2 Unserviceable-area marking

7.2.1 Unserviceable portions of a maneuvering area should be conspicuously marked with devices like cones, flags or marker boards placed at intervals that clearly mark the unserviceable area. Characteristics of unserviceable area marking devices are:

a) a cone should be at least **0.5 m** high;

b) a flag should be at least **0.5 m** square;

c) a marker board should be at least **0.5 m** high and **0.9 m** long; and

d) the foregoing devices should be red, orange or yellow or one of these colors in combination with white.

7.3 Pre-threshold area

7.3.1 Where the surface leading to the runway threshold is paved but is not suitable for normal use by aircraft and exceeds **60 m** in length, the entire pre-threshold should be marked with yellow chevron markings.

7.3.2 The chevrons should be formed of yellow stripes **0.9 m** wide and should be set at an angle of **45 degrees** to the extended runway centre line as shown in Figure 7.2 of *Annex 14, Volume I*.

7.4 Non-Loadbearing Surface Marking

7.4.1 Shoulders for taxiways, runway turn pads, aprons and other non-loading bearing surfaces which cannot readily be distinguished from load-bearing surfaces and which, if used by aeroplane, might result in damage to the aeroplane should have the boundary between such areas and the load-bearing surface marked by a taxi side stripe marking.

7.4.2 A taxi side stripe marking should consist of a pair of solid lines, each **15 cm** wide and spaced **15 cm** apart and the same colour as the taxiway centre line marking should be placed along the edge of the load-bearing pavement, with the outer edge of the marking approximately on the edge of the load-bearing pavement.

CHAPTER 8. EQUIPMENT AND INSTALLATIONS

8.1 Electrical power supply systems for air navigation facilities

8.1.1 Adequate power supply should be available at altiport for the safe functioning of air navigation facilities.

8.1.2 Where provided, the following aerodrome facilities should be provided with a power supply:

a) the signalling lamp and the minimum lighting necessary to enable air traffic services personnel to carry out their duties;

Note.— The requirement for minimum lighting may be met by other than electrical means.

b) all obstacle lights which, in the opinion of the appropriate authority, are essential to ensure the safe operation of aircraft;

c) meteorological equipment;

d) essential security lighting,

e) essential equipment and facilities for the aerodrome responding emergency agencies;

8.1.3 Requirements for a power supply should be met by either of the following:

— the public power, which is a source of power supplying the aerodrome service from a substation through a transmission line; or

— standby power unit(s), which are engine generators, solar-wind power, UPS batteries, etc., from which electric power can be obtained.

CHAPTER 9. ALTIPORT OPERATIONAL SERVICES, EQUIPMENT AND INSTALLATIONS

9.1 Altiport emergency planning

9.1.1 To prepare an altiport to cope with an emergency, altiport planners should use the specifications in *Annex 14, Volume I, Chapter 9*, and the emergency planning guidance contained in the *Airport Services Manual (Doc 9137), Part 7*, to develop an altiport emergency plan commensurate with aircraft operations and other activities.

9.1.2 When established, an altiport emergency plan should provide for the actions to be taken in an emergency occurring at the altiport or in its vicinity. The plan should co-ordinate the response or participation of all agencies that could assist in responding to an emergency. The outline of aerodrome emergency plan is given in *Appendix 2 of Airport Service Manual (Doc 9137), Part 7*.

9.1.3 There should be a procedure established for testing an altiport emergency plan with a view to improvement.

9.1.4 If the formal altiport emergency plan cannot be established, the altiport operator should establish an emergency management procedure in accordance with State regulations, which should include the followings:

(a) the positions of those who constitute the membership of the altiport emergency committee (if established);

(b) the description of the role of each emergency service organisation involved in the emergency response arrangements, as applicable;

(c) the procedures for liaison with the authorised person responsible for local emergency planning arrangements;

(d) the procedures for notification and initiation of an emergency response;

(e) the procedures for activation, control and coordination of altiport-based emergency responders (if any) during the initial stages of an emergency;

(f) the procedures for use of the altiport's emergency facilities (if any);

(g) the procedures for facilitating altiport access and the management of assembly areas (if any);

(h) the procedures for an altiport to respond to a "local stand-by" event, if applicable;

(i) the procedures for initial response to a "full emergency" event on, or in the immediate vicinity of, the altiport;

(j) the arrangements for keeping altiport emergency facilities, access points and assembly areas (if any) in a state of readiness;

(k) arrangements to ensure emergency preparedness by both on and off-altiport responders; and

(l) the arrangements to return the altiport to operational status after an emergency.

9.2 Rescue and firefighting

9.2.1 An altiport should be provided with appropriate rescue and firefighting equipment and services, the primary objective of which is to save lives in the event of an aircraft accident or fire at the altiport. This objective would be met by making a fire-free escape route for the evacuation or rescue of passengers and crew. A secondary objective is to protect property by containing or extinguishing fire resulting from an aircraft accident.

9.2.2 Rescue and firefighting services should also have a standby function, coming to a high state of readiness when an in-flight emergency is declared. Altiport operators should be guided on rescue and firefighting equipment and services by the specifications in *Annex 14, Volume I, Chapter 9,* and the material in *Annex 14, Volume I, Attachment A, Section 17,* and *the Airport Services Manual (Doc 9137), Part 1*.

9.2.3 When it is not feasible to provide the rescue and firefighting services at an altiport, the altiport operator should establish the following:

a) Installation of fire hydrants and firefighting facilities in appropriate places at an altiport;

b) Ensure the mechanism to deal with rescue operation in normal and difficult terrain during any aircraft incident or accident at or in the vicinity of an altiport;

c) Provision of basic firefighting training to operate the fire hydrants and installed firefighting equipment to the security staff or other available staff at an altiport in an event of fire incident; and

d) MOU with the local security and medical authorities from the vicinity of an altiport for necessary assistance in an event of aircraft incident and accident and structural fire.

9.3 Disabled aircraft removal

9.3.1 An altiport emergency plan should include a plan for removing a disabled aircraft that is on or adjacent to the movement area. Guidance on removal of a disabled aircraft is given in the *Airport Services Manual (Doc 9137), Part 5*.

9.3.2 If an altiport does not have a plan for removal of disabled aircraft, the altiport should have the procedures for removing an aircraft that is disabled on or near the movement area. The procedures may include the following:

a) identifying the roles of the altiport operator and the holder of the aircraft's certificate of registration;

b) notifying the holder of the certificate of registration;

c) obtaining appropriate equipment and persons to remove the aircraft;

d) identifying:

1) the names and roles of the persons responsible for arranging the removal of an aircraft; and

2) the telephone numbers for contacting the relevant individuals during and after normal working hours.

9.3.3 The procedures described in 9.3.2 should be in line with national regulations or local government regulations.

Note:- Light aircrafts can also be removed manually without necessitating any specialized equipment.

9.4 Wildlife strike hazard reduction

9.4.1 An altiport operator should institute a method of controlling wildlife (birds and animals) that constitute a hazard to aircraft operations. Guidance on wildlife hazard management is given in the *PANS-Aerodromes (Doc 9981), Part II, Chapter 6* and *Airport Services Manual (Doc 9137), Part 3*.

9.4.2 An altiport operator should institute a method of controlling wildlife hazard for the safe operation of an aircraft.

9.4.3 An altiport should have wildlife hazard management procedures to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the altiport, including details of the arrangements for the following:

a) monitoring wildlife activities at the aerodrome;

b) assessing any wildlife hazard;

c) mitigating any wildlife hazard;

d) reporting wildlife hazards to aircraft through one or more of the following as applicable: the AIP, NOTAM, air traffic control;

e) identifying proposed or actual sources of wildlife attraction outside the altiport boundary; and

f) liaising with the relevant planning authorities or proponents to facilitate wildlife hazard mitigation.

9.5 Apron Safety

9.5.1 Procedures on apron safety are specified in the *PANS-Aerodromes (Doc 9981), Part II, Chapter 7*.

9.6 Altiport vehicle operation

9.6.1 *Annex 14, Volume 1, Attachment A, Section 18* and *PANS-Aerodromes (Doc 9981), Part II, Chapter 9 may be used for altiport vehicle operation.*

9.7 Siting of equipment and installations on operational areas

9.7.1 Unless its function requires it to be there for air navigation or for aircraft safety purposes, no equipment or installation should be:

a) on a runway strip, a taxiway strip if it would endanger an aircraft; or

b) on a clearway if it would endanger an aircraft in the air.

9.7.2 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on a runway strip and which:

a) penetrates the lateral (transitional) surface should be of minimum mass and height, frangibly designed and sited to reduce hazards to a minimum. Guidance on the frangibility requirements of navigation aids is contained in the *Aerodrome Design Manual (Doc 9157), Part 6.*

9.8 Fencing

9.8.1 A fence or other suitable barrier should be provided on an altiport:

a) to prevent the entrance to the movement area of animals large enough to be a hazard to aircraft; and

b) to deter the inadvertent or premeditated access of an unauthorized person onto a non-public area of the altiport.

9.8.2 Suitable means of protection should be provided to deter the inadvertent or premeditated access of unauthorized persons into ground installations and facilities essential for the safety of civil aviation located off the altiport.

9.8.3 A fence or other means should separate the movement area and other facilities or zones on the altiport essential to safe operations from areas open to the public.

9.8.4 Wherever fencing is not feasible to be provided some kind of mechanism should be employed to protect the movement area for the safety of aircraft operations.

CHAPTER 10. ALTIPORT MAINTENANCE

10.1 General

10.1.1 A maintenance programme, including preventive maintenance, should be established at an altiport to maintain facilities in a condition that does not impair safety, regularity or efficiency of air navigation.

10.1.2 A maintenance programme developed in accordance with *Annex 14, Volume I, Chapter 10*, and using the following guidance would be suitable for an altiport.

a) Guidance on the maintenance of runway shoulders is contained in *Annex 14, Volume I, Attachment A, Section8.1*, and in the *Aerodrome Design Manual (Doc 9157), Part 2.*

b) Guidance on maintenance of a runway surface to preclude harmful irregularities is given in *Annex 14, Volume I, Attachment A, Section 5*.

c) Guidance on runway condition report for reporting runway surface condition is given in *Annex 14, Volume I, Attachment A, Section 6, PANS-Aerodromes (Doc 9981), Part II, Chapter 2 and Circular 355*.

d) Guidance on improving braking action and on the clearing of runways is given in the *Airport Services Manual (Doc 9137), Part 2*.

e) Guidance on suitable chemicals for removing or preventing frost or ice on pavements is given in the *Airport Services Manual (Doc 9137), Part 2*.

10.1.3 A system of preventive maintenance of visual aids should be employed to ensure marking system reliability. Guidance on preventive maintenance of visual aids is given in the *Airport Services Manual (Doc 9137), Part 9*.

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APPENDIX 1 - ALTIPORT DESIGN AEROPLANES

Notes:- Table 1 contains a list of aeroplanes in operations at altiports in Indonesia and Nepal. It should be noted that operations by these aeroplanes require special authorization by the manufacturers for Maximum Performance STOL Operations and approved by the local regulatory authority.

Table 1

S. No	Aeroplanes	Remarks
A)	**Indonesia**	
1	Cessna - 206	
2	Cessna - 208	
3	PC-6	
4	DHC - 4 Carribou	
5	DHC - 6	
B)	**Nepal**	
	DHC 6 - 300	
	DHC 6 - 400 (Viking)	
	DO 228 - 212	
	L 410 UVP – E20	

ATTACHMENT A

GUIDANCE MATERIAL SUPPLEMENTARY TO ASIA PACIFIC GUIDANCE ON DESIGN AND OPERATIONS OF ALTIPORTS

1. Runway length

1.1 As for conventional aerodromes, the determination of the length[4] of an altiport runway requires the involvement of an expert service or organization. The simplified method, which is described below, is nevertheless a fairly good approximation for light aeroplanes.

1.2 For the longitudinal profile slopes adopted at altiports, the acceleration of an aeroplane at take-off is only significantly affected, in its rolling phase, compared to what it would be on a substantially horizontal runway, by the effect of the orthogonal projection of the aeroplane's weight on the runway's axis.

1.3 Therefore, if aH denotes the acceleration of the aircraft traveling at speed V on a horizontal runway Figure A1 - 1, the acceleration aα of the same aircraft traveling at the same speed on a slope of an angle α to the horizontal as shown in the Figure A1 - 2 has the value:

$\mathbf{a}_\alpha = \mathbf{a}_H + g.\ sin\ \alpha$ **------A**

Figure A1-1

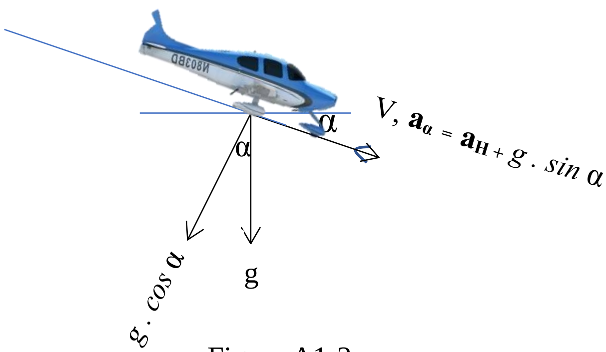

Figure A1-2

1.4 In the case of the deceleration corresponding to an acceleration-stop procedure the force due to gravity would be in opposite direction with respect to deceleration hence the equation-A may be rewrite as:

$\mathbf{a}_\alpha = \mathbf{a}_H - g\ .\ sin\ \alpha$. **-------- B**

1.5 The assumption is made below that an acceleration aH is invariant of the aeroplane type which makes this method as the approximation method.

1.6 Let us take the scenario with the multiple slopes of the runway, where the aeroplane movement uniformly accelerated (respectively decelerated) on each segment of runway i of constant slope αi and applying the newton's law of motion elimination of the time variable between

[4] *In view of the significant slopes, it is specified that the length referred to here is that measured on the ground.*

expressions the distance traveled on the axis and the speed leads to the relation:

$2ad = v_f^2 - v_i^2$;

where,

'a' is an acceleration, 'd' is distance travelled and v_f^2 is the final velocity and v_i^2 is the initial velocity of any object/aeroplane.

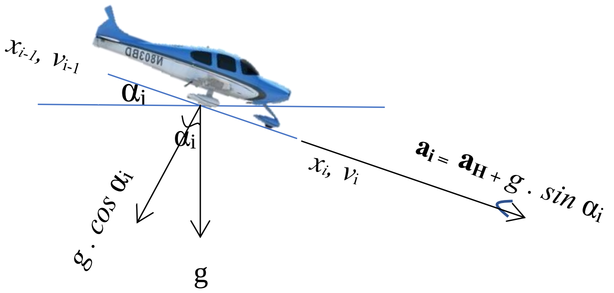

Figure A1-3

$2\,\mathbf{a}_i \cdot (x_i - x_{i-1}) = v_i^2 - v_{i-1}^2$ ---------**C**

in which:

- ✓ $\mathbf{a}_i = \mathbf{a_H} + g.\ \sin \alpha_i$
- ✓ $(x_i - x_{i-1})$ is the length of the section**,**
- ✓ v_{i-1} is the speed at the origin of said section,
- ✓ v_i is the speed at its end.

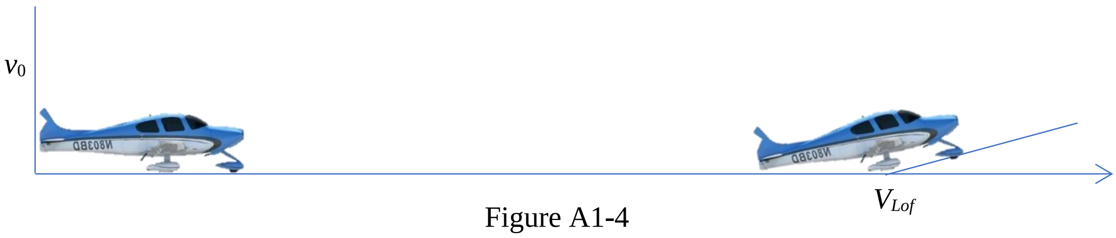

Figure A1-4

1.7 By successively writing this relation for each section of constant slope since the release brake ($v_0 = 0$) until the speed reaches the flight speed V_{Lof}, we obtain a series of equalities, which, by addition, results in the formula giving the length of runway preceding the point where the reference aeroplane leaves the ground after having initiated it's pitch up Figure A1-4.

$2\,\Sigma\,\mathbf{a}_i \cdot (x_i - x_{i-1}) = V_{Lof}^2$---------**D**

1.8 Note that by making $\alpha = 0$, in the equation-**D** allows to substitute for the parameter $\mathbf{a}_i$ by value $\mathbf{a_H}$, whose value is not published with respect to the speed V_{Lof} and the distance at the end of at which this speed is reached on a horizontal runway.

1.9 For altiports intended to accommodate exclusively only light aeroplane, to which the method above is intended, the length to be given to the runway is taken equal to the product by **1.25** of the distance thus calculated from the equation-**D**.

1.10 The length of the runway determined under 1.9 should be increased at the rate of 7 per cent per

300 m elevation.

1.11 The length of runway determined under 1.10 should be further increased at the rate of 1 per cent for every 1°C by which the aerodrome reference temperature exceeds the temperature in the standard atmosphere for the aerodrome elevation (see *Table 3-1 of Aerodrome Design Manual (Doc 9157), Part 1 Runways*). If, however, the total correction for elevation and temperature exceeds 35 per cent, the required corrections should be obtained by means of a specific study. The operational characteristics of certain altiport design aeroplanes may indicate that these correction constants for elevation and temperature are not appropriate, and that they may need to be modified by results of aeronautical study based upon conditions existing at the particular site and the operating requirements of such aeroplanes.

1.12 Although current regulations do not require accelerate-stop for light aeroplanes, there is no reason why the possibility of a rejected take-off should not be considered in determining the runway length. Since the above reason applies to the deceleration introduced by the initiation of an accelerate-stop procedure, the decision speed, as may be, as it has been developed, can be determined within its possible range.

1.13 The length of an altiport runway does not necessarily have to provide for operations by the design aeroplane at its maximum mass. Rather, the aeroplane mass selected should be the mass required to carry out its allocated task and different take-off and landing masses may be determined for each site served by the design aeroplane.

2. Runway width

2.1 The width of an altiport runway may be determined by reference to the minimum values previously provided[5] for conventional aerodromes, according to the reference code of the most critical altiport design aeroplane to be accommodated.

2.2 On the basis of this information, if the code letter of an aeroplane does not seem to specify it differently for an altiport than for conventional aerodromes, the fact that the reference field length of the same aeroplane is not in itself significant for an altiport, should not, considering the correlation that exists between this distance and the one necessary for this aeroplane to reach its speed of rotation, be considered as removing all validity to the use of the code number[5] that is associated with it.

2.3 The minimum widths previously provided for conventional aerodromes will therefore be applicable without correction to altiports.

2.4 Thus, the minimum width of the runway will be **60 m** in unpaved configuration.

2.5 For paved runways, the absolute minimum width is **18 m**.

2.6 The site selection and orientation of a runway in the mountains is generally quite constrained, so particular attention must be paid to crosswinds in determining the width of the runway beyond the minimums thus defined.

[5] *although this situation cannot be established as a rule, it should be noted that, as they use a short take-off and landing runway, the aircraft used at the altiport generally use the code number 1*

ATTACHMENT B

CAA NEPAL PRACTICES FOR SHORT TAKE-OFF AND LANDING (STOL) OPERATIONS

(Refer to Chapter – 14, Part I - Flight Crew and Part II - STOL Fields Clearance Requirements)

URL:

https://caanepal.gov.np/storage/app/media/file%20upload/fora-6th-edition-consolidated-1-026262626.pdf

ATTACHMENT C
OBSTACLES LIMITATION SURFACES

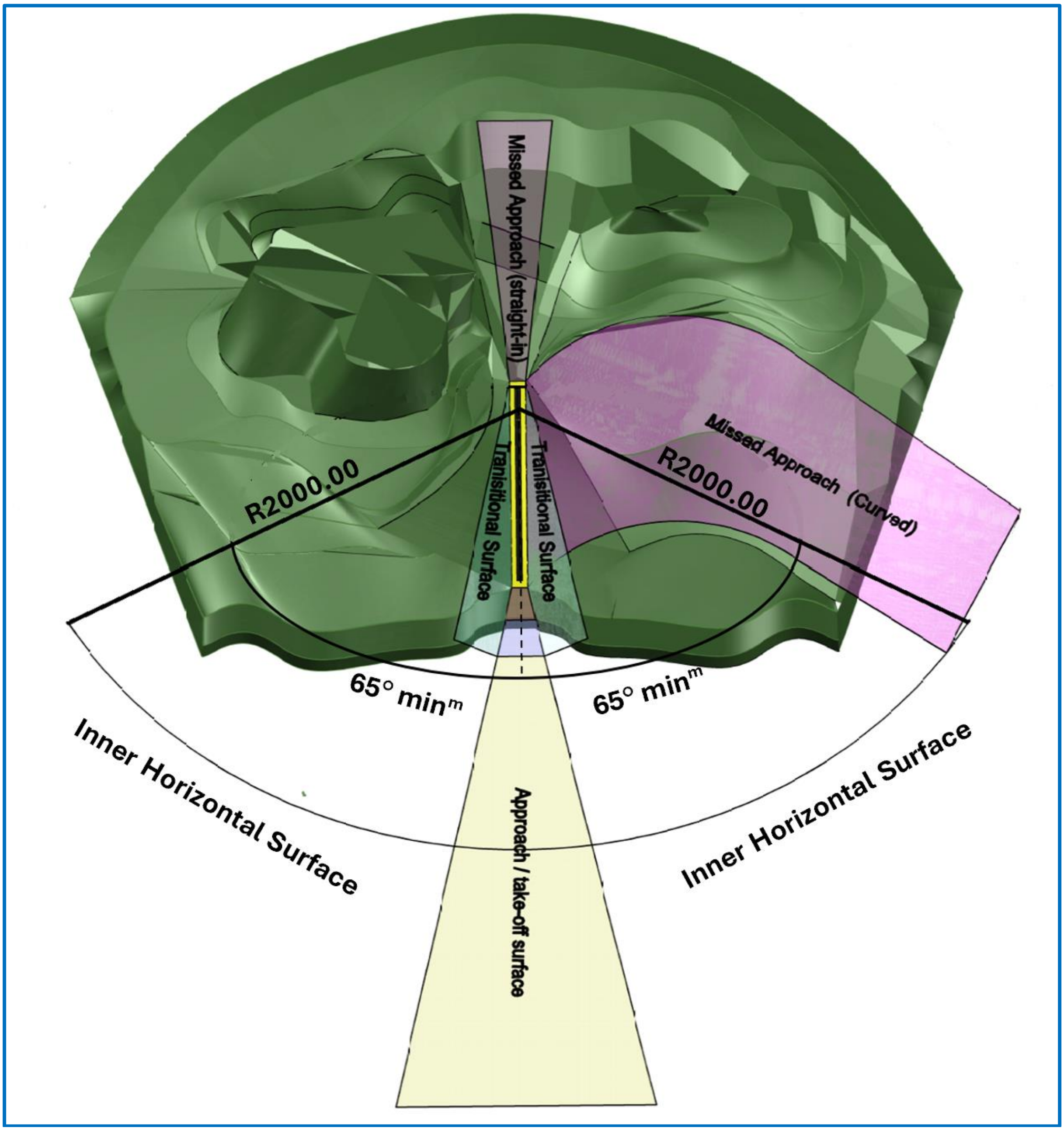

Figure ATT C-1: Missed approach surfaces at altiports in mountain pass or on dome shaped landforms

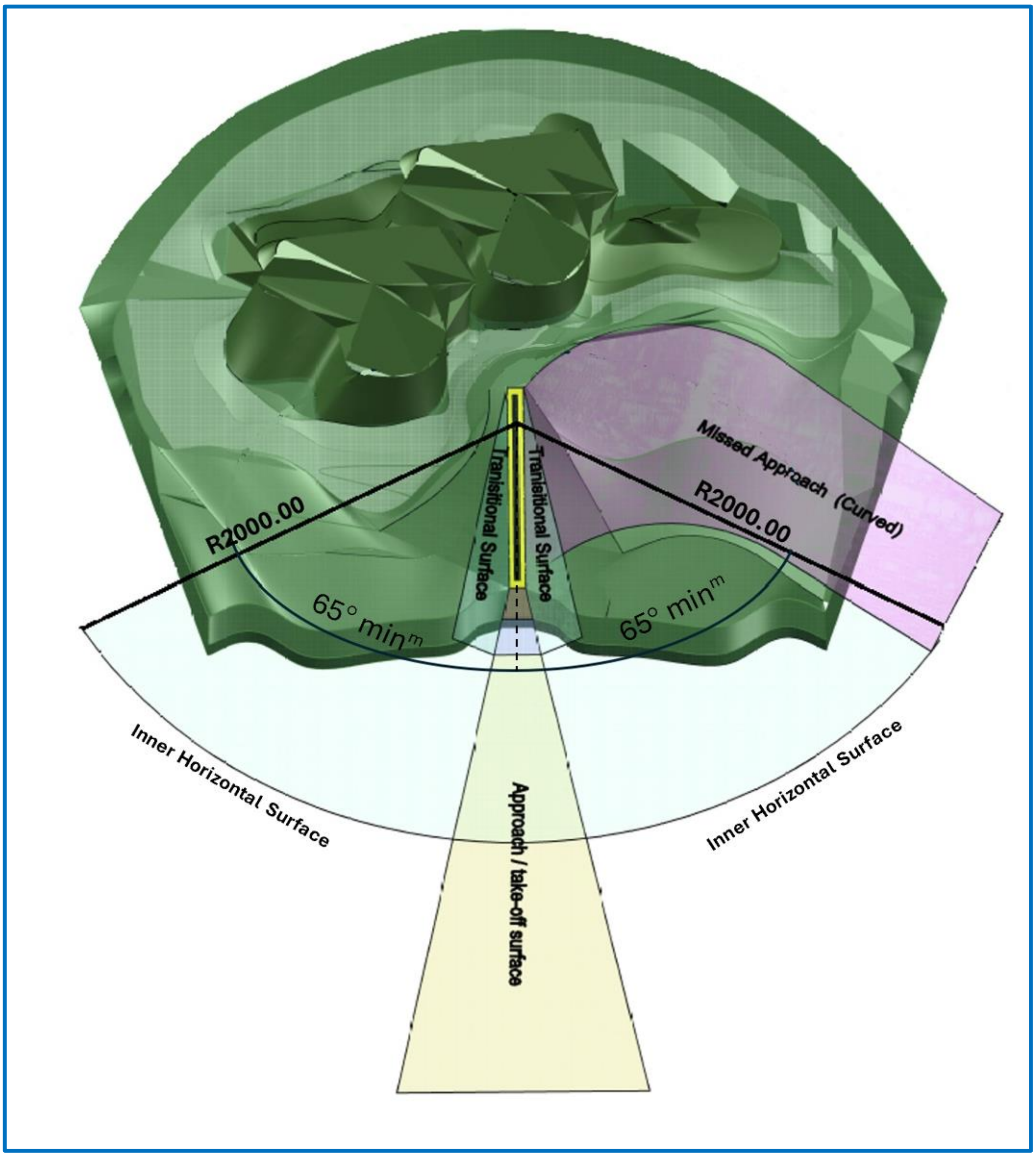

Figure ATT C-2: Missed approach surfaces at altiport on a mountain side

ATTACHMENT D

REFERENCES

1) ICAO Annex 14 Aerodromes, Volume I Aerodrome Design and Operations

2) Aerodrome Design Manual (Doc 9157, Part 1 to 6

3) Airport Planning Manual (Doc 9184), Part 1 – 3

4) Airport Services Manual (Doc 9137), part 1 - 8

5) Stolport Manual (Doc 9150);

6) Instruction Technique sur les Aérodromes Civils (ITAC), DGAC France

7) UNDP/ICAO Project, NEP/82/009, High –altitude STOL Performance Criteria Study, DHC 6 – 300 Series Twin Otter Aircraft, Nepal, February 1988

8) CAAN Flight Operations Requirements Aeroplane, Appendix 9 - STOL Field Clearance Requirements

9) Minimum Safety Requirements for Temporary / Unlicensed Aerodromes, DGCA India;

10) CASA CAAP 92A-1(0): Guidelines on Aerodromes intended for Small Aeroplanes conducting RPT Operations;

11) FAA AC 150/5325-4B: Runway Length Requirements for Airport Design, Chapter 2 Runway Length for Small Airplanes;

12) FAA AC 150/5220-22B: Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns;

13) AC139-6 Aerodrome design, Aeroplanes at or Below 5700 kg MCTOW (2015)

14) Supplement No. 178R2 of LET410 UVP-E20

15) Supplement No 1131, Dornier 228

16) PSM1 – 64 – POH, DHC – 6 – Twin Otter – Pilot Operating Handbook, Section 10.10.1 - Maximum Performance STOL Operations into Section 10 of PSM1-64-POH, after Temporary Revision 23.

AP-ADO/TF TASK LIST

(Updated by AP-ADO/TF/5)

	ACTION ITEM/PLANNED ACTIVITIES	RESPONSIBLE PARTY	TIME FRAME	STATUS	REMARKS
1/1	Identify experts in various AOP fields and maintain a database for the Asia/Pacific Region	States – nomination of experts Secretariat – maintaining database	Continuous	Open	From TOR
1/2	Draft regional guidance for the design and operations of:				From AP-ADO/TF/1 AP-ADO/TF/2 - WP/13
	(a) Altiports	Nepal to lead; assisted by China, Fiji, India and Indonesia	December 2021 Final Draft to be submitted to AOP/SG/8	Ongoing	Modified in AP-ADO/TF/2 AP-ADO/TF/3-WP/09 - First draft of the GM AP-ADO/TF/4-WP/09 – Second Draft of the GM AP-ADO/TF/5-WP/11 – Third Draft of the GM

	ACTION ITEM/PLANNED ACTIVITIES	RESPONSIBLE PARTY	TIME FRAME	STATUS	REMARKS
1/3	- Study and discuss aerodrome SARPs and guidance materials related to aerodrome planning, design and operations including PANS-Aerodromes; and - Provide expert advice and clarification to APAC States on any issues related to the implementation of the requirement specified in the SARPs and guidance materials. [Reference: From TOR]	States and AP-ADO/TF AP-ADO/TF and Secretariat	Continuous Continuous	Ongoing Ongoing	~~1st sub-item:~~ ~~– AP-ADO/TF/2 WP/05, WP/06, IP/02, IP/03 & IP/04~~ ~~– AP-ADO/TF/3 IP/04~~ ~~– AP-ADO/TF/4 IP/03, PPT/01 & 02; WP/04, 05, 06 & 07~~
1/4	- Review and discuss AOP parts of the Asia/Pacific ANP and Seamless ANS Plan; and - Formulate amendment proposals to the APAC ANP Table AOP I - 1 and Table AOP II – 1 as necessary. [Reference: From TOR]	AP-ADO/TF States and Secretariat	Continuous Continuous	Ongoing Ongoing	~~1st sub-item:~~ ~~– AP-ADO/TF/2 WP/03 & WP/08~~ ~~– AP-ADO/TF/3 WP/08~~ ~~– AP-ADO/TF/4 WP/08~~ ~~PfAs from 5 States had been processed and completed in 2022~~ PfAs for six States have been completed in 2023. Processing of PfAs submitted by two other States are in progress.

	ACTION ITEM/PLANNED ACTIVITIES	RESPONSIBLE PARTY	TIME FRAME	STATUS	REMARKS
2/1	Conduct seminars / workshops for aerodrome regulatory and aerodrome operator staff in APAC Region		Continuous	Ongoing	~~China, India & Thailand implemented GRF on 4 Nov. 2021.~~ Conducted GRF Webinars in 2021 in coordination with: − FTF, ACI, IFALPA, IFATCA and IFAIMA − Japan incorporating winter operations
3/1	Technical assistance/Workshop for APAC States that have yet to implement GRF	United States FAA (upon request and on case by case basis)	~~2022~~ Continuous	Ongoing	Nil request received from States
3/2	GRF Seminar	China (Lead), ACI & ICAO	Q3, 2022	Completed	Seminar on GRF - *Ten Months into GRF, Challenges Met and Lessons Learnt in Asia-Pacific* conducted by ICAO jointly with China and ACI on 29 Sep. 2022
AP-ADO/TF/4					
4/1	Workshop on Aerodrome Pavement Design and Evaluation including ICAO ACR-PCR Method in Reporting Pavement Strength for Asia and Pacific Regions	With FAA support and Secretariat	Q1, 2024		~~To organize back-to-back with AP-ADO/TF/5 Meeting in Jan/Feb 2024 or as standalone workshop at the convenient dates.~~ Aerodrome Pavement Workshop conducted from 7 to 9 Feb. 2024

	ACTION ITEM/PLANNED ACTIVITIES	RESPONSIBLE PARTY	TIME FRAME	STATUS	REMARKS
AP-ADO/TF/5					
5/1	Develop Regional guidance material on the transposition of Annex 14 ICAO SARPs	**Malaysia** (Lead), ROK, Nepal, PNG, Australia, Thailand & ACI,	By November 2024		
5/2	Organize workshops on the transposition of Annex 14 SARPs into National Standards	**Malaysia** (Lead), ACI and Secretariat	In conjunction with AP-ADO/TF/6 in Jan/Feb 2025		
5/3	Organize workshops for States and aerodrome operators to share experience in AGA audit area of USOAP CMA especially on alternative means of compliance with AGA related SARPs as advocated for in DGCA/58/DP3/01	**Pakistan** (Lead – TBC by AOP/SG/8), Australia, China (TBC by AOP/SG/8), India, Secretariat	In conjunction with AOP/SG/9 in July 2025		
5/4	Regional Guidance on Risk Assessment for Lights with the Hazardous Effects	**ROK** (Lead), India Nepal, Thailand	Dec 2025		
5/5	Regional Guidance for Strength assessment and classification for grass and unpaved runway [Task 7/2 from AOP/SG/7]	**PNG** (Lead), Nepal, Australia	Dec 2025		